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CATALOGUE

OF THE

MAMMALS

OF

WESTERN EUROPE

(EUROPE EXCLUSIVE OF RUSSIA)

IN THE

COLLECTION

OF THE

BRITISH MUSEUM

(Natural History)

BY

GERRIT S. MILLER

LONDON

PRINTED BY ORDER OF THE TRUSTEES OF THE BRITISH MUSEUM

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B. QUARITCH, 11, GRAFTON STREET, NEW BOND STREET, W.
DULAU & Co., LTD., 37, SOHO SQUARE, W.
AND AT THE
BRITISH MUSEUM (NATURAL HISTORY), CROMWELL ROAD, S.W.

1912

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LONDON:
PRINTED BY WILLIAM CLOWES AND SONS, LIMITED,
DUKE STREET, STAMFORD STREET, S.E., AND GREAT WINDMILL STREET, W.

pp. xv, 1019: text illust.

PREFACE

Although the idea of a publication on the Mammals of Europe was suggested many years ago by the late Lord Lilford, who kindly contributed an annual sum towards the collecting necessary for its realization, the possibility of issuing the present Catalogue has mainly grown up from the work which its author, Mr. Gerrit S. Miller, of the United States National Museum at Washington, has for some years been doing independently on the subject.

It is true that European Mammals had not been neglected here, and that the collection had begun to grow, both by the help of the Lilford Fund and by the efforts of Major G. E. H. Barrett-Hamilton, who published many papers on the subject, and of Mr. Oldfield Thomas, F.R.S., who devoted a number of his vacations to collecting in various parts of the Continent.

There was, however, no prospect of being in a position to prepare a Catalogue until about 1905, when Mr. Miller arranged to devote his entire time for a considerable period to the study of European Mammals. The opportunity was taken of having the results of this work published here instead of in America, by inducing him to write a British Museum Catalogue; thus utilizing his knowledge, and combining for the purposes of his studies the material of both the American and the British National Museums.

Collections were then made in various selected areas, partly by Mr. Miller himself and partly by trained collectors, such as Messrs. A. Robert, C. Mottaz, Rev. S. Gonzalez and N. Gonzalez, the cost of whose services were contributed by friends of the Museum, notably Mr. Oldfield Thomas, the Hon. N. C. Rothschild and Mr. J. I. S. Whitaker. The Catalogue could hardly have been contemplated if it had not been for Mr. Thomas' unremitting efforts in developing

the collection. He has not merely regarded these efforts as an official duty, but he has in addition been a generous donor who has frequently supplied funds for the purpose of obtaining specimens. Mr. Miller has thus had at his disposal a collection fairly representative of all parts of Western Europe, and immensely superior to anything that had been thought of before he began his work.

Marine Mammals (Cetacea and Pinnipedia) are not included in the present Catalogue. For a definition of "Western Europe" reference must be made to page vii of the Author's Introduction.

As Mr. Miller is on the staff of the United States National Museum the special and cordial thanks of the Trustees of the British Museum are due to the authorities of the former Institution for the facilities granted to him for carrying through the preparation of the Catalogue, a work which involved a furlough of two years and a half from his usual duties at Washington.

The thanks of the Trustees are also due to Mrs. Oldfield Thomas and to Mr. R. C. Wroughton for their kindness in undertaking the considerable labour of preparing and verifying the lists of the specimens in the Museum collection after Mr. Miller had made his scientific determinations.

SIDNEY F. HARMER,
Keeper of Zoology.

British Museum (Natural History),
London, S.W.

October, 1912.

INTRODUCTION

The collection of European Land-mammals in the British Museum consists of about five thousand specimens. One hundred and twenty-four of these are types. It has for the most part been brought together during the past thirty years through the efforts of the late Lord Lilford, of Mr. Oldfield Thomas, and of Major G. E. H. Barrett-Hamilton. The older material, though not extensive, includes much that is of historic interest, such as the numerous specimens received from the late Baron E. de Sélys-Longchamps, the types of various species described by Gray and Bonaparte, and Darwin's Porto Santo rabbits which have been the subject of so much groundless speculation. It is, however, from the recently-obtained material that the collection derives its true value. These specimens are almost without exception carefully-prepared skins accompanied by skulls and measurements, together with full records of sex, date, and exact locality. The more important sources from which they were obtained are as follows: collections brought together by Professor W. Wolterstorff from central and eastern Germany, and presented by the late Lord Lilford; collections made in Roumania by the late E. Dodson under the direction of Major G. E. H. Barrett-Hamilton, and presented by the late Lord Lilford; material from southern Spain presented by the late Lord Lilford; extensive collections made in south-western France, in southern Italy and in Sicily by A. Robert and presented by Mr. Oldfield Thomas; collections from south-central France and the vicinity of Strassburg, Germany, made by C. Mottaz and presented by Mr. O. Thomas; small collections from Denmark, Holland, Pas-de-Calais, Brittany, Portugal, the Balearic Islands, Switzerland and northern Italy, made and presented by Mr. O. Thomas; collection from central and northern Spain made by N. Gonzalez and presented by Mr. O. Thomas; a large collection from miscellaneous sources brought together and presented by Major G. E. H. Barrett-Hamilton; a collection from Greece made by C. Mottaz and presented by

Mr. J. I. S. Whitaker and the Hon. N. C. Rothschild; a collection from Spain and southern France made by G. S. Miller and purchased by the Museum; several collections from Transylvania made by C. G. Danford; collections from Hungary made and presented by the Hon. N. C. Rothschild and Mrs. Rothschild; smaller collections and single specimens have been received from many other persons,* whose names will be found in the detailed lists of material in this Catalogue.

Although unquestionably forming the largest of all collections of European mammals the material in the British Museum is not sufficient to be made the basis of a monographic study of the fauna. Free use has, therefore, been made, throughout the preparation of this Catalogue, of specimens in other collections. Chief among these are the United States National Museum in Washington and the private collection of Charles Mottaz in Geneva. The material at Washington, about 4000 specimens, is mostly from the following sources: (*a*) Sweden, Germany, Switzerland and Belgium, collected by J. Alden Loring; (*b*) Sicily, Italy and the region of Barcelonnette, Basses-Alpes, France, by Dane Coolidge; (*c*) south-western France, by Robert T. Young; (*d*) north-eastern Germany, the Riesengebirge and Harz Mountains, by F. L. J. Boettcher. There are also miscellaneous smaller collections from Switzerland (G. S. Miller, L. Stejneger, E. H. Zollikofer), Belgium (de Sélys-Longchamps), Holland (G. S. Miller), Denmark (L. Stejneger), Norway (T. Stejneger) and Sweden (Sundevall, Tullberg, Lönnberg). Finally, the Merriam collection, now the property of the U.S. National Museum but not yet catalogued, contains numerous European specimens, for the most part received from de Sélys-Longchamps. The Mottaz collection, about 3000 specimens, is especially rich in series of the smaller mammals of Switzerland and the adjoining portions of France; it also contains useful material from Italy and western France (Charente). Other supplemental material to which I have been given free access, or which has been sent for examination in London or Washington, is contained in the museums of Madrid (types of Cabrera), Nîmes (types of Crespon), Paris (types of Geoffroy and other historic specimens), Genoa (Italian Bats, Microtines and Ungulates), Turin (Italian mammals, especially Ungulates), Naples (type of *Myotis oxygnathus* Monticelli), Geneva (types of Fatio, authentic Swiss

* This is particularly true of the many friends of the Museum who have aided in procuring the large series of British mammals.

specimens of *Lynx*), Lausanne Agricultural School (skull of *Ursus "formicarius"* from the Alps), Munich (type of *Spalax græcus* Nehring), Berlin Agricultural High School (type of *Arvicola ratticeps stimmingi* Nehring), Breslau (skulls of foxes), Leiden (co-types of *Arvicola arenarius* de Sélys-Longchamps), Copenhagen (*Mus færoensis* and small carnivores), Christiania (*Sorex*, *Evotomys*, etc.), Stockholm (Swedish carnivores and rodents), Cambridge (*Mustela erminea ricinæ*, *Lemmus lemmus "crassidens"*) and Edinburgh (rodents from northern Scotland). Private collections which have been in the same generous manner placed at my disposal are those of Mr. Angel Cabrera, of Madrid (Spanish mammals, including several types), Dr. Enrico Festa, of Turin (Italian mammals), Mr. Angelo Ghidini, of Geneva (Swiss and north Italian mammals), and Dr. Fernand Lataste, of Cadillac-sur-Garonne, France (carnivores and microtines).

The total number of specimens on which this work is based approximates 11,500. All those of which definite record has been made are enumerated in the paragraphs headed : Specimens examined.* Absence of a note to the contrary indicates that all the specimens from a given locality are in the British Museum. Discrepancies frequently occur between the number of "specimens examined" and the number tabulated in the final paragraph as forming part of the Museum collection. These result from the fact that under "specimens examined" are included duplicates as well as registered specimens, while only the latter appear in the final lists.†

For the purposes of this Catalogue, "Western Europe" is regarded as including the continent of Europe outside the frontiers of Russia; also the immediately adjacent islands, and Spitzbergen, Iceland, and the Azores. The members of the living mammal fauna of this region, exclusive of the cetaceans, pinnipeds, and species such as *Bubalus bubalis* in Italy and *Simia sylvanus* ‡ on the Rock of Gibraltar, which certainly owe

* In these lists 11,372 specimens are recorded. They are distributed as follows: Insectivora, 1,777; Chiroptera, 2,210; Carnivora, 877; Rodentia Duplicidentata, 379, Rodentia Simplicidentata, 5,854; Ungulata, 284.

† Certain duplicates have been transferred to the United States National Museum since the lists of "specimens examined" were prepared. No attempt has been made to alter the records in the lists on this account; but the U.S.N.M. numbers of such specimens are frequently to be found in the Tables of cranial measurements. (All numbers above 10,000 indicate specimens in Washington.)

‡ For use of this name in place of "*Macacus inuus*," see Thomas, Proc. Zool. Soc. London, 1911, pp. 125–126, March, 1911.

their presence to artificial introduction, are treated monographically on the basis of the material already enumerated. This material has been found sufficient, in most of the groups, to give what appears to be a fairly satisfactory idea of the essential features of the fauna. In the ungulates and the larger carnivores, however, it is so totally inadequate that no attempt could be made to revise the genera by which they are represented. This is especially to be regretted on account of the fact that some of these larger mammals are nearly extinct, while others are being modified by the introduction of foreign stock to replenish exhausted game preserves. Immediate action is necessary if the final opportunity to gain a clear understanding of this part of the European fauna is not to be lost.

The literature of European mammals is so voluminous, particularly as regards local lists and special notes on distribution, and it is for the most part based on conceptions of species and local races so different from those underlying the present work, that an amount of labour incommensurate with the importance of the results would be required to prepare extended bibliographical Tables for each form recognized. The citations are, therefore, restricted to those which seem of importance in giving a clear idea of the systematic history of each animal; that is, to the specific and sub-specific names under which it may have been described, to the first use of the actual binomial or trinomial here adopted, to the names used in the monographic works of Blasius, 1857, and Trouessart, 1910, and to any other publication which might seem pertinent to a particular case.

In deciding questions of nomenclature, an attempt has been made to apply the International Code and the rulings of the Commission strictly and consistently, even to the reluctant acceptance of the terms applied to genera by authors who followed a system different from that now in use.

With the exception of figure 121, lent by the Smithsonian Institution, all the illustrations are original. The drawings of teeth were made in London by Mr. A. J. Engel Terzi; part of those of the skulls were made by Mr. Terzi; the rest were done in Washington by Mr. H. B. Bradford.

A few words in conclusion regarding the actual making of the manuscript. I prepared all the descriptions, synonymies, lists of specimens examined, and Tables of cranial measurements. The external measurements, which are not to be regarded as

more than approximately accurate, are mostly given as recorded on the labels, though much verification and correction for ears and hind feet has been done from the dried specimens. In order to economize time, the records of registered material were made directly from the specimens which I had identified. Mrs. Oldfield Thomas and Mr. R. C. Wroughton carried out this portion of the work.

G. S. M.

WASHINGTON,
July 1, 1912.

ORDER.	Number of genera recognized.	Number of forms recognized.	Number of forms not represented in B.M.	Number of recognized forms not seen.
INSECTIVORA . . .	7	45	5	0
CHIROPTERA . . .	10	33	0	0
CARNIVORA . . .	15	47	1	0
RODENTIA DUPLICIDENTATA	2	19	1	0
,, SIMPLICIDENTATA	26	139	6	2
UNGULATA . . .	9	31	9	4
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CATALOGUE

OF THE

LAND-MAMMALS OF WESTERN EUROPE.

Order INSECTIVORA.

1827. *Insectivora* Gray, Griffith's Cuvier, Anim. Kingd., v, p. 100.

Geographical distribution.—Africa (including Madagascar), Europe, Asia (including the Malay Archipelago), North America, Greater Antilles, and extreme north-western portion of South America.

Characters.—Terrestrial, non volant, placental mammals with low development of brain, the cerebral hemispheres without convolutions; teeth of a primitive or modified tuberculo-sectorial type, the posterior upper premolar and anterior lower molar never specially modified as carnassials.

Remarks.—The mammals of this order present such diversity of form and structure that it is difficult to frame any definition by which all members of the group may be invariably recognized by skeletal or external characters. Ten families of *Insectivora* are currently recognized, three of them occurring in Europe.

KEY TO THE EUROPEAN FAMILIES OF *INSECTIVORA*.

Dentition of a semi-crushing type: first and second upper molars with four subequal cusps, their styles and commissures rudimentary; sutures in skull persistent; a large external pterygoid plate; zygomatic arch complete, heavy. (In European species back covered with spines.) (Hedgehogs)..... *Erinaceidæ*, p. 114.

Dentition of a strictly sectorial type: first and second upper molars with three or four cusps strongly contrasted in size, their styles and commissures highly developed and forming an important functional part of tooth; sutures in skull mostly disappearing early in life; no external pterygoid plate; zygomatic arch slender or incomplete. (Back covered with soft, dense fur.)

Anterior lower incisor greatly elongated in axis of jaw; mandibular articulation double; zygoma absent; floor of brain-case with large lateral vacuities; no auditory bulla; general form mouse-like, the neck evident; external ear present (Shrews)..... *Soricidæ*, p. 28.

Anterior lower incisor not elongated in axis of jaw; mandibular articulation single (normal); zygoma present; floor of brain-case bony throughout; a small auditory bulla; general form not mouse-like, the neck concealed between the greatly enlarged shoulders; no external ear (Moles and Desmans) ..... *Talpidæ*, p. 2.

Teeth in front of molars sharply differentiated by form into incisors, canines and premolars, the upper incisors small, sub-equal; front feet highly modified for burrowing, the palms everted; tail scarcely as long as head (Moles) *Talpinæ*, p. 2.

Teeth in front of molars not differentiated by form into incisors, canines and premolars, the inner upper incisor greatly enlarged, vertical, trenchant; front feet not modified for burrowing (habits aquatic), the palms in normal position; tail (in European members of the group) longer than head and body (Desmans) *Desmaninæ*, p. 20.

Family TALPIDÆ.

1825. *Talpidæ* Gray, Thomson's Annals of Philosophy, xxvi, p. 339.

Geographical distribution.—North temperate portions of Old and New Worlds; in Europe south to the Mediterranean coast and west to England.

Characters.—Skull long and narrow, strongly tapering anteriorly, most of its sutures disappearing early in life; zygomatic arch complete, slender; floor of brain-case completely ossified; tympanic bone attached to skull, forming a flattened bulla; mandible with single articulation, the glenoid surface normal; no external pterygoid plate; crowns of upper molars low, much narrower internally than externally, the paracone and metacone near middle of crown, the commissures and styles well developed and forming with corresponding portions of lower teeth an effective cutting apparatus; body heavy, cylindrical, the short neck concealed between the greatly developed shoulders; eye minute, often covered by the integument; snout much elongated, terete or depressed; no external ear.

Remarks.—The members of the family *Talpidæ* are at once recognizable among European mammals by the great development of the shoulder girdle and apparent absence of neck, the auditory orifice seeming to lie at the shoulder. Though excessively modified in general form the *Talpidæ* are much less specialized than the *Soricidæ* in the more fundamental characters of skull and teeth. The family is divisible into several very distinct groups or subfamilies, two of which are represented in Europe. In one of these the animals are specially adapted to subterranean habits; in the other they are modified for aquatic life.

Sub-Family TALPINÆ.

Geographical distribution.—Temperate portions of Europe and Asia, from England to Japan; in Europe south to the Mediterranean coast.

Characters.—Teeth in front of molars sharply differentiated by form into incisors, canines, and premolars, the incisors, both above and below, small, sub-equal, chisel-shaped, the upper canine large, strongly trenchant; external form highly modified for subterranean life, the greatly enlarged orbicular front feet with palms permanently turned outward, the hind feet much smaller, not peculiar in form; tail short; muzzle terete.

Remarks.—This group, composed of the true moles of the Old World, and specially characterized by the relatively primitive condition of the anterior teeth, is represented by four or five genera, one of which occurs in Europe.

Genus **TALPA** Linnæus.

1758. *Talpa* Linnæus, Syst. Nat., I, 10th ed., p. 52.

Type species.—*Talpa europæa* Linnæus.

Geographical distribution.—Europe and western and central Asia. Eastern limits of range not known.

Characters.—Dental formula: $i\frac{3-3}{3-3}$, $c\frac{1-1}{1-1}$, $pm\frac{4-4}{4-4}$, $m\frac{3-3}{3-3} = 44$. Upper premolars small, distinctly spaced, showing no tendency to become imbricated. Lower canine slightly but evidently differentiated from incisors in size and form; auditory bulla very slightly inflated, its outlines usually indistinct, the meatus small, sub-circular; external form strictly talpine; ear-conch absent; eye minute, often covered by the skin.

Remarks.—The genus *Talpa* contains half a dozen or more species. Four of these occur in Europe, one of them generally distributed, the three others confined to the Mediterranean region.

KEY TO THE EUROPEAN SPECIES OF *TALPA*.

Greatest diameter of m^1 about 4 mm.; three lower molars together about 8 mm. (vicinity of Rome) ..... *T. romana*, p. 18.

Greatest diameter of m^1 about 3 mm.; three lower molars together about 7 mm. or less.

Condylobasal length of skull 33 to 37 mm. (distribution general) ..... *T. europæa*, p. 3.

Condylobasal length of skull 29 to 32 mm. (southern).

Posterior border of anteorbital foramen over front of last molar (Italian)..... *T. cæca*, p. 15.

Posterior border of anteorbital foramen over middle of second molar (Iberian) ..... *T. occidentalis*, p. 15.

TALPA EUROPÆA Linnæus.

1758. *Talpa europæa* Linnæus, Syst. Nat., I, 10th ed., p. 52 (Sweden).

1766. *Talpa frisius* P. L. S. Müller, Natursyst. Suppl. u. Regist.-Band, p. 36 (Ostfriesland).

1772. *Talpa caudata* Boddaert, Kortbegrip van het zamenstel der Natuur, I, p. 50 (Renaming of *europæa*).

1777. [*Talpa europæa*] α *albo-maculata* Erxleben, Syst. Regni Anim., I, p. 117 (Ostfriesland).

1785. [*Talpa*] *vulgaris* Boddaert, Elenchus Anim., I, p. 126 (Europe).

1789. [*Talpa europæa*] β *variegata* Gmelin, Syst. Nat., I, 13th ed., p. 110 (Sweden).

1789. [*Talpa europæa*] γ *alba* Gmelin, Syst. Nat., I, 13th ed., p. 110 (Sweden).

1789. *Talpa europæa* ε *cinerea* Gmelin, Syst. Nat., I, 13th ed., p. 110 (Eifel, Germany).

1792. *Talpa europ*[*æa*] *nigra* Kerr, Anim. Kingd., p. 200 (Renaming of *europæa*).

1797. *Talpa europæa rufa* Borkhausen, Der Zoologe (Compendiose Bibliothek gemeinnützigsten Kenntnisse für alle Stände, pt. XXI), Heft V–VIII, p. 13 (Southern France).

1836. *Talpa europæa flavescens* Reichenbach, Pracht.-gemeinn. der Säugeth. des In- und Auslandes, fig. 473 (Saxony).

1852. *Talpa europæa albida* Reichenbach, Vollständigste Naturgesch. des In- und Auslandes, IV, p. 336 (Germany).

1852. *Talpa europæa lutea* Reichenbach, Vollständigste Naturgesch. des In- und Auslandes, IV, p. 336 (Germany).

1857. *Talpa europæa* Blasius, Säugethiere Deutschlands, p. 109.

1869. *Talpa europæa, flavescens* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LIX, pt. I, p. 400.

1869. *Talpa europæa, maculata* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LIX, pt. I, p. 401 (Renaming of *albo-maculata*).

1869. *Talpa europæa* β *grisea* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LIX, pt. I, p. 403 (synonym of *cinerea* wrongly attributed to Zimmermann, Geogr. Gesch., II, p. 390, 1780, where vernacular name only is used).

1897. [*Talpa*] *scalops* Schulze, Abh. u. Vortr. Gesammtb. Naturw. IV, no. 10, p. 19. (Substitute for *europæa*.)

1910. *Talpa europæa* Trouessart, Faune Mamm. d'Europe, p. 61.

Type locality.—Upsala, Sweden.

Geographical distribution.—Europe from Great Britain and the Channel Islands eastward, and from the Mediterranean coast to Scotland and central Sweden.

Diagnosis.—Size medium (hind foot about 18 mm., condylobasal length of skull rarely less than 33 mm.); skull with orbit rather long, so that distance from posterior border of orbit to posterior border of anteorbital foramen is about equal to that from latter point to front of first premolar or back of canine; teeth of moderate size, the length of upper tooth-row (exclusive of incisors) less than 14 mm., the greatest diameter of m^1 about 3 mm.; mesostyle of m^2 and m^3 entire or with apex slightly notched.

External characters.—General form highly modified for subterranean burrowing habits, the neck so short that the conical head with much produced snout appears to be joined directly, between the very large, everted front feet, to broad, powerful shoulders, behind which the unusually long, nearly cylindrical body tapers gradually to somewhat weak and narrow pelvic region. Fur dense and velvety, the hairs all of the same length,

about 12 mm. long throughout body, shorter on head. Muzzle pad well developed, slightly wider than high, its entire margin free, the upper edge folded back and with a deep narrow median emargination, the whole surface finely and evenly rugose. Behind pad the skin of the muzzle is naked and wrinkled along median line above, the exact size and form of the naked area varying in different individuals, but its length usually about 7 mm., its breadth anteriorly equal to greatest diameter of pad, that posteriorly somewhat less. Under side of upper lip with deep median groove extending forward to muzzle-pad. Eyes excessively minute, less than 1 mm. in diameter, in some individuals completely covered by the integument, in others with a pin-hole aperture.* No external ear, the meatus about 2·5 mm. in diameter. Legs so short that scarcely more than the feet project beyond general integument of body. This is particularly true of the front legs, which are entirely concealed to wrist. Front feet very large, the palms orbicular, permanently turned outward, their surface naked, finely and evenly tuberculo-reticulate, without trace of pads. Toes, five, each armed with a long, slightly-curved nail broadly grooved along under surface, that of fifth digit not so large as the others. Third digit longest, second and fourth sub-equal and slightly shorter, first and fifth slightly shorter than second and fourth. Hind foot short, somewhat triangular in outline, broad through base of toes but narrowing rapidly toward heel, the five toes with well developed, curved, but not flattened claws, much less enlarged than those of front foot; second, third and fourth digits sub-equal and longest, fifth and first successively shorter, soles naked, reticulate, with five rudimentary tubercles at bases of digits, and a fifth near middle of inner margin, its anterior extremity projecting so as to suggest a supplemental (clawless) toe. Dorsum of pes thinly clothed, the hairs at its edge forming a slight fringe. Tail thickened and fleshy, about $1\frac{1}{2}$ times as long as hind foot, subterete but somewhat compressed, much constricted basally: scales arranged in rather irregular rings, of which there are about twelve to the centimeter at middle; hairs of tail sparse, not concealing rings, sometimes forming a thin pencil. Mammæ: $p\,2-2$; $i\,2-2=8$.

Colour.—Fur everywhere dark slaty grey, sometimes almost blackish, at others more nearly a dark smoke-grey, the hairs everywhere with a noticeable metallic or purplish iridescence: underparts sometimes a little less dark than back, and occasionally with a yellowish brown suffusion; tail concolor with body.

Skull. The skull is long and narrow, tapering gradually forward from middle of brain-case, the widest region, to just behind canines, the extreme tip of rostrum widening a little, the zygomatic arches not standing out beyond general contour.

* Much confusion has been caused by the supposition that the presence or absence of this minute aperture is a specific or racial character.

Outline when viewed from the side long wedge-shaped, rounded off posteriorly. Surface of skull smooth, except for a slight sagittal crest, present in old individuals along course of parietal suture, and a crest-like elevation extending forward and outward from antero-external angle of interparietal along edge of slightly inflated mastoid region, and terminating anteriorly in a slightly pointed projection. Brain-case with posterior margin nearly semicircular to projecting points already mentioned, then abruptly conical to back of interorbital region, its outline when viewed from behind fusiform, a little less than half as deep as wide; condyles slightly projecting, but not noticeably breaking general posterior outline. Interparietal large, strap-shaped, slightly convex in front, similarly concave behind, the lateral extremities squarely truncate, its antero-posterior diameter about one-third transverse diameter. Its anterior and lateral sutures remain visible, but the lambdoid suture is nearly obliterated early in life, though its position is usually marked by a slight ridge representing the lambdoid crest. Base of brain-case smooth, without conspicuous ridges, furrows or open spaces, the bones for the most part somewhat inflated; two ill-defined pits in surface of basioccipital in front of foramen magnum; a shallow, broadly triangular median furrow between the low, flattened bullæ, the sub-circular, slightly triangular outline of which is sometimes distinctly indicated, but more often very obscure; auditory meatus small, nearly circular.

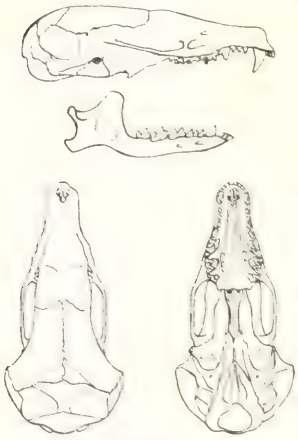

FIG. 1.

Talpa europæa. Nat. size.

Inner pterygoid plate small but well developed, the hamulars short, turned slightly outward; mesopterygoid space much narrower posteriorly than anteriorly, its greatest breadth less than half length, its length much more than width of palate between posterior molars, its anterior border broadly rounded; region outside pterygoid plate inflated and with low but distinct longitudinal ridge, convergent anteriorly with that forming edge of mesopterygoid space. Interorbital region sub-cylindrical, distinctly expanded at middle. Rostrum narrower and somewhat abruptly lower than interorbital region, its narrowest point just behind canines; nares with evident posterior emargination. Anterorbital foramen moderately large, its posterior border over metastyle of m^2, the plate forming outer wall of canal usually much narrower than foramen. Lachrymal foramen above anteor-

bital foramen and slightly in front of its middle; its orifice over metastyle of m^1. Temporal fossa rather large, the distance from its posterior border to posterior border of anteorbital foramen equal to that from latter point to front of first premolar or back of canine. Palate moderately broad, without special peculiarities of form, terminating posteriorly, a little behind m^3, in a slightly raised crescentic ridge; a vacuity about as large as the minute incisive foramen on each side of palate opposite space between m^1 and m^2. Mandible rather slender, the ramus curved downward near middle and upward posteriorly, the angular process nearly on level with alveolar line. Coronoid process large, its broadly rounded off extremity rising considerably above articular level, its height above alveolar line about equal to least breadth of posterior segment of mandible. Articular process slender, the single articular surface small, normal in position. Angular process slightly longer than articular process, and distinctly broader, forming an obliquely-set plate directed almost horizontally backward, the extremity slightly hooked upward.

Teeth.—In proportion to the size of the skull the teeth are moderately large, their general aspect noticeably trenchant. Upper incisors simple, chisel-shaped, perpendicular, forming a strongly convex row between canines, their height equal, but their breadth diminishing regularly from first to third; crowns of first and second usually in contact, that of third separated by a slight space from second and from canine. Lower incisors projecting somewhat obliquely forward, essentially similar to the upper teeth in form, but smaller and narrower. Upper canine large, two-rooted,* the height of the shaft greater than that of any of the other teeth, and fully equal to anterior breadth of palate; shaft wider anteriorly than posteriorly, with antero-internal longitudinal groove, and highly developed, slightly concave posterior cutting edge. Lower canine very small, resembling a fourth incisor, but with shaft conical instead of chisel-shaped.

FIG. 2.
Talpa europæa. Teeth × 3.

* The roots of this tooth as well as those of the small premolars are distinctly visible in old individuals.

and set in the jaw at a slightly different angle posterior surface of shaft with well developed longitudinal ridge. First, second and third upper premolars two-rooted, small, their points on level with those of incisors and inner cusps of molars, their crowns separated from each other as well as from canine and large premolar by narrow equal spaces; crowns rather higher than long, compressed, with slightly developed posterior cutting edge, narrowly triangular in outline when viewed from the side, the first more slender than the others, the second and third with slight though evident postero-external angle on cutting edge. Fourth premolar essentially like the other three in form, but much larger and three-rooted, the length of crown greater in proportion to height: no secondary cusps. Lower premolars two-rooted, similar to the upper teeth in form, the second and third the same size as smaller upper premolars, the first nearly as large as pm^4, but narrower, owing to absence of third root, the fourth intermediate. Upper molars with crowns much wider externally than internally, and completely divided into two unequal sections by a deep longitudinal groove passing between protocone and bases of paracone and metacone. Protocone large, its posterior commissure extending in line parallel to sagittal plane, and ending abruptly at posterior edge of crown, near which it is slightly thickened, its anterior commissure similar though shorter, but usually showing some trace of thickening,* particularly in m^2. Paracone and metacone sub-equal in m^2 and m^3, the metacone the larger in the former, the paracone in the latter. In m^1 the metacone is about double the size of paracone, and is the largest and highest cusp of the upper molar series, its posterior cutting edge and long commissure functioning with similarly enlarged protoconid of m_2. Styles and outer commissures well developed in m^2 and forming a distinct W-pattern: mesostyle entire or with apex slightly notched. In m^1 the parastyle is reduced to a minute though usually evident cusplet on the cingulum, and the mesostyle to a thickening or angle in commissure connecting the two main cusps; metastyle well developed.† In m^3 the parastyle, mesostyle and their commissures are well developed, metastyle and fourth commissure absent; mesostyle with apex usually bifid. Middle lower molar largest, its protoconid the highest cusp in the series. First lower molar broader posteriorly than anteriorly, second and third slightly broader anteriorly than posteriorly, the two triangles essentially alike in form. Metaconid of m_1 low, scarcely more

* The thickenings vary considerably in different individuals. Occasionally they are obsolete, but more frequently they are so well developed as to form an evident protoconule and metaconule, the latter always the larger of the two.

† In this tooth there is no anterior V, the outer surface of paracone essentially resembling that of pm^4 except for its smaller size.

than a slight thickening of the cingulum. In the other teeth it is a well developed cusp nearly equal to entoconid. In all three teeth the outer cusps are noticeably higher than those of the inner row.

Measurements.—Average and extremes of five males from Borrohol, Sutherland, Scotland: head and body, 148·4 (145–152); tail, 26·8 (26–28); hind foot, 18·8 (18–19). Average and extremes of four females from the same locality: head and body, 135 (133–138); tail, 25·3 (24–28); hind foot, 17·5 (17–18). Average and extremes of five males from Solférino, Landes, France: head and body, 138 (134–142); tail, 26·2 (25–28); hind foot, 17·8 (17–18). Five females from the same locality: head and body, 128·6 (126–133); tail, 27·4 (25–29); hind foot, 17·2 (17–18). Average and extremes of six males from Lucinges, Haute-Savoie, France: head and body, 136·6 (132–140); tail, 24·8 (23–26); hind foot, 18·1 (17–19). Average and extremes of three males from Turin, Italy: head and body, 138·3 (123–147); tail, 31 (27–34); hind foot, 19·2 (18–20). Average and extremes of eight males from the Dehesa de Valencia, Spain: head and body, 144·3 (135–165); tail, 26·6 (26–28); hind foot, 18·1 (18–19). For cranial measurements see Table, p. 12.

Specimens examined.—Three hundred and ninety, from the following localities:—

Scotland: Borrohol, Sutherland, 9 (Wilson); Black Isle, Cromarty, 3; Cromarty, 1; Gordonstown, Elgin, 1; Grantown-on-Spey, Elgin, 13 (Wilson); Cortachy, Forfar, 1 (Wilson); Stockbriggs, Lanarkshire, 1.

England: Bowdon, Cheshire, 1; Altrincham, Chester, Cheshire, 1; Parsop, Hereford, 1; Lavenham, Suffolk, 1 (Wilson); Barrow, Suffolk, 1 (U.S.N.M.); Arley, Staffordshire, 1 (Wilson); Rugby, Warwickshire, 2; Warwickshire, no exact locality, 2; Fulbourn, Cambridge, 1; Holloway, Somersetshire, 2; Somersetshire, no exact locality, 1; Banstead, Surrey, 2; Coombe, Surrey, 1; Cobham, Surrey, 2; Egham, Surrey, 2; Knockholt, Kent, 2; Bromley, Kent, 2; Devonshire, no exact locality, 3.

Denmark: No exact locality, 1 (U.S.N.M.).

Belgium: Waremme, Liége, 3 (U.S.N.M.).

France: Guines, Pas-de-Calais, 1; Pont-de-Briques, Pas-de-Calais, 1: Trinity, Jersey, 2; St. Lawrence, Jersey, 1; Barbizon, Seine-et-Marne, 2: Melun, Seine-et-Marne, 1 (Mottaz); Lignières, Charente, 1 (Mottaz): Huelgoat, Brittany, 1; Cadillac-sur-Garonne, Gironde, 1 (U.S.N.M.): Fôret de Bouconne, Gers, 13; Solférino, Landes, 10; Caterille, Haute-Garonne, 10; Legouvin, Haute-Garonne, 3; Luchon, Haute-Garonne, 3; Barèges, Hautes-Pyrénées, 5; l'Hospitalet, Ariège, 1; Porté, Pyrénées-Orientales, 3; St. Gilles, Gard, 1; Valescure, Var, 1; Agay, Var, 1; Étupes, Doubs, 3 (Mottaz); Lucinges, Haute-Savoie, 9; Montauban, Haute-Savoie, 15; Cranves-Sales, Haute-Savoie, 12.

Spain: Pajáres, Leon, 2; Castrillo de la Reina, Burgos, 9; Castañares, Burgos, 8; Lérida, 1; Barracas, Castellon, 24; Catarroja, Valencia, 1; Dehesa de Valencia, Valencia, 17.

Germany: Königsberg, 4 (U.S.N.M.); Moritzburg, Saxony, 8 (U.S.N.M): Ummerstadt, Thüringen, 3; Brunswick, 15 (U.S.N.M.); Aachen, 9 (U.S.N.M.); Bremen, 1; Ingelheim, Rheinhessen, 4; Strass, near Burgheim, Bavaria, 7; Niesky, Silesia, 1; Kalbe, Saale, 2; Magdeburg, Saxony, 1; Strassburg, 3.

Austria-Hungary: Csallóköz-Somorja, Pressburg, Hungary, 2; Hatszeg, Hunyad, Transylvania, 2.

ROUMANIA: Bustenari, Prahova, 1; Comana, Vlasca, 1; Bucharest, 1 (Genoa).

BULGARIA: Sofia, 1 (Andersen).

SWITZERLAND: Geneva, 15 (U.S.N.M. and Mottaz); Lausanne, Vaud, 1 (U.S.N.M.); Les Plans, Vaud, 2 (U.S.N.M.); Chesières, Vaud, 1 (Mottaz); Andermatt, Uri, 2 (U.S.N.M.); Mürren, 1; Thurgau, 1; Oberhasli Valley, 1; St. Gallen, 3; Rheinthal, St. Gallen, 2; Degersheim, St. Gallen, 3; Gossau, St. Gallen, 3; Untervatz, Grisons, 1; Breganzona, Ticino, 1; Cortivallo, Ticino, 6 (B.M. and U.S.N.M.); Comano, Ticino, 2 (U.S.N.M.); Lugano, Ticino, 4 (B.M. and U.S.N.M.); Muzzano, Ticino, 2 (B.M. and U.S.N.M.); Sorengo, 1 (U.S.N.M.); Cremignone, Ticino, 1.

ITALY: Turin, 4 (U.S.N.M.); Certosa di Pesio, Cuneo, 1 (Genoa); Parma, 2 (U.S.N.M.); Gozzano, Novara, 3 (Genoa); Frugarolo, Alessandria, 4 (Genoa); Vaccarezza, 1 (Genoa); Perti, Finalborgo, 10 (Genoa); Florence, 10 (U.S.N.M.).

Remarks.—With the possible exception of certain bats, the common mole shows less tendency to vary geographically than any other European mammal of equally wide range.

2 ♂.	Black Isle, Cromarty, Scotland.	W. R. Ogilvie-Grant (P).	11. 1. 3. 62–63.
♀.	Gordonstown, Elgin.	W. R. Ogilvie-Grant (P).	11. 1. 3. 66.
♂.	Stockbriggs, Lanarkshire.	E. R. Alston (P).	79. 9. 25. 3.
♀.	Parsop, Herefordshire, England.	E. A. Denny (P).	11. 1. 3. 67.
2 ♂.	Rugby, Warwickshire.	E. E. Austen (P).	11. 1. 3. 64–65.
2.	Warwickshire.	Tomes Collection.	7. 1. 1. 17–18.
♂.	Fulbourn, Cambridgeshire.		11. 1. 3. 71.
2 al.	Holloway, Somerset.	H. King (P).	58. 4. 22. 1–2.
2.	Somerset. (*Hügel.*)	E. R. Alston (P).	79. 9. 25. 5–6.
2 al.	Cobham, Surrey.	Dr. Leach (P).	
1 al. 1.	Egham, Surrey.	F. Heiss (P).	58. 1. 2. 1–2.
♀.	Knockholt, Kent.	W. Blackwell (P).	11. 1. 3. 61.
2 ♂. al.	Bromley, Kent.	H. E. Rawson (P).	81. 4. 2. 1–2.
3 ♂.	Devonshire.	Oxley Grabham (P).	11. 1. 3. 68–70.
2 ♂.	Trinity, Jersey, Channel Islands. (*R. H. Bunting.*)	O. Thomas (P).	8. 9. 2. 3–4.
♀.	St. Lawrence, Jersey.	Mrs. Power (P).	8. 12. 17. 1.
♂.	Guines, Pas-de-Calais, 80 ft. France.	O. Thomas (C & P).	94, 6. 6. 19.
♂.	Pont-de-Briques, Pas-de-Calais.	O. Thomas (C & P).	98. 1. 9. 3.
♂.	Huelgoat, Brittany, 600 ft.	O. Thomas (C & P).	92. 9. 5. 1.
2 ♂, 2 ♀.	Forêt de Bouconne, Gers, 250 m. (*A. Robert.*)	O. Thomas (P).	6. 4. 1. 28–31.
2 ♂, 2 ♀.	Solférino, Landes. (*A. Robert.*)	O. Thomas (P).	6. 4. 1. 32–35.
2 ♂, 2 ♀.	Caterille, Haute-Garonne, 900–1000 m. (*A. Robert.*)	O. Thomas (P).	6. 4. 1. 24–27.
2 ♂, ♀.	Luchon, Haute-Garonne. (*A. Robert.*)	O. Thomas (P.)	6. 4. 1. 21–23.
2 ♂, 1 ♀.	Barèges, Hautes-Pyrénées.	G. S. Miller (C).	8. 8. 4. 129–132.
♂.	L'Hospitalet, Ariège. (*A. Robert.*)	O. Thomas (P).	8. 9. 1. 38.
♂.	Porté, Pyrénées-Orientales.	G. S. Miller (C).	8. 8. 4. 133.
2 ♂	Porté, Pyrénées-Orientales, 1600–1700 m. (*A. Robert.*)	O. Thomas (P).	8. 9. 1. 36–37.
♂.	Valescure, Var.	G. S. Miller (C).	8. 8. 4. 134.

♂.	Agay, Var.	G. S. Miller (C).	8. 8. 4. 135.
1.	Montauban, Haute-Savoie, 1000 m.	A. Robert (C & P).	97. 1. 9. 1.
3 ♂, 1 ♀.	Cranves-Sales, Haute-Savoie, 900 m.	A. Robert (C & P).	5. 4. 4. 1. 5. 4, 9. 3–5.
5 ♂, 3 ♀.	Cranves-Sales, Haute-Savoie, 909–1200 m. France. (*A. Robert.*)	O. Thomas (P).	5. 11. 18. 1–8.
♂, ♀.	Pajáres, Leon, Spain. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 26–27.
2.	Castrillo de la Reina, Burgos, Spain.	G. S. Miller (C).	8. 8. 4. 20–21.
2 ♂, 5 ♀.	Castrillo de la Reina, Burgos.	N. Gonzalez (C.)	8. 7. 7. 1–7.
♂.	Lérida, Spain. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 28.
6 ♂, 6 ♀.	Barracas, Castellon. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 29–40.
3 ♂, ♀.	Catarroja, Valencia. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 12–15.
4 ♂, 5 ♀.	Dehesa de Valencia, Valencia. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 17–25.
3 ♂, ♀.	Ingelheim, Rheinhessen, Germany.	C. Hilgert (C).	8. 11. 2. 11–14.
♂, ♀.	Ummerstadt, Thüringen. (*Schuchardt.*)	Lord Lilford (P).	11.1.1.115–116.
♂.	Ummerstadt, Thüringen. (*Schuchardt.*)	Lord Lilford (P).	11. 1. 1. 137.
♂, 3 ♀.	Strass, Burgheim, Bavaria. (*Körbitz.*)	Lord Lilford (P).	11. 1. 1. 1–4.
2 ♂, ♀.	Strass, Burgheim, Bavaria. (*Körbitz.*)	Lord Lilford (P).	11.1.1.132–134.
♂.	Niesky, Silesia. (*W. Baer.*)	Dr. E. Hamilton (P).	97. 12. 4.18.
♀.	Kalbe, Saale. (*W. Bauer.*)	Lord Lilford (P).	11. 1. 1. 5.
♂.	Kalbe, Saale. (*W. Bauer.*)	Lord Lilford (P).	11. 1. 1. 136.
♂.	Magdeburg, Saxony. (*Wolterstorff.*)	Lord Lilford (P).	11. 1. 1. 135.
♂, ♀.	Strassburg, Alsace. (*C. Mottaz.*)	O. Thomas (P).	8. 8. 10. 10–11.
2.	Csallóköz-Somorja, Pressburg, Hungary.	Budapest Museum (P).	94. 3. 1. 27–28.
2 ♂.	Hatszeg, Hunyad, Transylvania, Hungary.	C. G. Danford (C).	3. 2. 2. 20–21.
♂.	Bustenari, Prahova, Roumania. (*W. Dodson.*)	Lord Lilford (P).	4. 4. 6. 13.
♂.	Comana, Vlasca, Roumania.	Lord Lilford (P).	4. 4. 6. 14.
1.	Mürren, Switzerland.	W. Gärtner (P).	92. 10. 5. 3.
♀.	Thurgau, 400 m. Switzerland. (*E. H. Zollikofer.*)	O. Thomas (P).	4. 4. 5. 26.
1.	Oberhasli Valley, Switzerland. (*Koeserman.*)	Tomes Collection.	7. 1. 1. 130.
2 ♂, ♀	St. Gallen, 650 m. Switzerland. (*E. H. Zollikofer*).	O. Thomas (P).	4. 4. 5. 23–25.
♂.	Breganzona, Ticino, Switzerland. (*E. H. Zollikofer*).	O. Thomas (P).	2. 8. 4. 17.
♂.	Cortivallo, Ticino. (*E. H. Zollikofer*).	O. Thomas (P).	2. 8. 4. 15.
♀.	Lugano, Ticino, 300 m.	O. Thomas (C & P).	2. 7. 1. 1.
♂.	Muzzano, Ticino. (*E. H. Zollikofer*).	O. Thomas (P).	2. 8. 4. 16.
♀.	Cremignone, Ticino. (*E. H. Zollikofer*).	O. Thomas (P).	2. 8. 4. 20.

Locality.	Number.	Sex	Condylobasal length.	Zygomatic breadth.	Breadth of braincase.	Depth of braincase through bulla.	Greatest interorbital breadth.	Rostral breadth over canines.	Mandible.	Maxillary tooth-row (exclusive of incisors).	Mandibular tooth-row (entire alveoli).	Observations.
Scotland: Black Isle, Cromarty.	152372	♂	35·4	12·2	17·2	10·6	8·6	5·0	23·4	13·0	13·0	Teeth moderately worn.
,, ,, ,,	11. 1. 3. 63	♂	36·0	13·0	17·6	10·6	8·4	5·0	23·8	13·4	13·0	,, ,, ,,
Cromarty . .	11. 1. 3. 62	♂	34·0	—	17·0	10·6	8·4	4·8	22·0	12·8	13·0	,, slightly worn.
England: Parsop, Hereford .	11. 1. 3. 67	♀	33·2	12·0	16·0	9·8	8·0	4·6	21·2	12·2	12·2	,, much worn.
Rugby . . .	11. 1. 3. 64	♂	35·4	12·2	16·8	10·2	8·2	5·0	22·8	13·2	13·0	,, slightly worn.
,, . . .	11. 1. 3. 65	♂	35·8	13·0	17·8	10·2	8·8	5·0	23·0	13·0	13·2	,, moderately worn.
Coombe, Surrey .	152371	♂	35·0	12·0	16·8	10·4	8·6	5·0	22·8	13·2	13·2	,, slightly worn.
Knockholt, Kent .	11. 1. 3. 61	♂	—	11·6	15·8	9·8	8·2	4·6	22·2	12·8	13·0	,, ,,
,, ,, .	152370	♂	34·2	12·0	16·2	10·2	8·0	5·0	22·2	12·6	12·6	,, ,,
Belgium: Waremme, Liège .	86006	♂	34·2	11·8	16·0	10·0	8·0	4·8	21·6	12·6	12·6	,, moderately worn.
,, ,, .	86005	♀	34·2	11·8	16·4	10·0	8·0	4·6	21·8	13·0	12·8	,, slightly worn.
France: Pont-de-Briques, Pas-de-Calais .	98. 1. 9. 3	♂	35·0	12·2	17·2	11·0	8·0	5·0	22·8	12·8	13·2	,, ,,
Trinity, Jersey . .	8. 9. 2. 3	♂	—	—				4·8	—	13·0	13·0	,, much worn.
,, ,, .	8. 9. 2. 4	♂	33·8	11·4	16·2	9·8	7·8	4·6	22·0	12·8	13·0	,, slightly worn.
Huelgoat, Brittany .	92. 9. 5. 1	♂	34·8	12·2	16·8	10·0	8·0	4·8	22·6	13·0	13·0	,, ,,
Bouconne, Gers .	6. 4. 1. 28	♂	36·1	12·4	17·4	11·0	8·8	5·2	23·6	13·2	13·4	,, ,,
,, ,, .	6. 4. 1. 29	♂	37·0	13·0	17·0	11·0	8·2	5·2	24·0	13·6	13·8	,, ,,
,, ,, .	6. 4. 1. 30	♀	35·0	12+	17·0	10·8	8·4	5·0	23·4	12·8	13·0	,, ,,
,, ,, .	6. 4. 1. 31	♀	34·0	11·8	16·8	11·0	8·0	4·8	22·0	13·0	13·0	,, ,,
Solférino, Landes .	6. 4. 1. 34	♀	33·4		16·2	9·8	8·2	5·0	21·8	12·2	12·4	,, moderately worn.
Luchon, Haute-Garonne	6. 4. 1. 21	♂	33·2	11·6	16·2	10·2	8·4	4·6	21·6	12·6	12·8	,, slightly worn.
,, ,, ,,	6. 4. 1. 22	♂	33·6	11·4	16·0	10·0	8·2	5·0	22·0	12·6	13·0	,, ,,
,, ,, ,,	6. 4. 1. 23	♀	32·4	11·2	15·8	9·8	8·0	4·8	21·0	12·2	12·6	,, ,,
Caterille ,, ,	6. 4. 1. 24	♂	35·0	11·8	16·4	10·8	8·2	4·8	22·4	13·0	13·0	,, ,,
,, ,, ,,	6. 4. 1. 25	♂	36·4	12·0	16·8	10·2	8·2	5·0	23·6	13·6	13·6	,, moderately worn.
,, ,, ,,	6. 4. 1. 26	♀	35·4	12·0	16·8	10·6	8·0	5·0	23·0	13·0	13·0	,, slightly worn.
,, ,, ,,	6. 4. 1. 27	♀	31·2	11·8	15·4	10·0	8·0	4·6	22·4	13·0	13·2	,, ,,

France: Cranves-Sales, Haute-Savoie	5. 11. 18. 1	♂	33·4	12·0	16·6	9·8	8·0	4·8	21·0	12·0	12·0	Teeth moderately worn.
„ „ „	5. 11. 18. 2	♂	33·4	12·0	16·4	10·0	7·8	4·8	21·2	12·0	12·2	„ „
„ „ „	5. 11. 18. 3	♂	34·4	12·0	16·4	10·0	8·0	4·8	21·0	12·4	12·6	„ „
„ „ „	5. 11. 18. 5	♂	35·0	12·0	16·4	10·0	8·0	4·8	21·6	12·8	12·8	„ much worn.
„ „ „	5. 11. 18. 8	♀	32·2	11·4	15·2	9·8	7·6	4·6	20·4	11·8	12·0	„ moderately worn.
„ „ „	5. 4. 9. 5	♀	33·0	11·8	16·2	10·0	7·2	4·6	20·8	12·0	12·2	„ slightly worn.
„ „ „	5. 4. 9. 7	♀	32·8	11·4	—	9·2	7·6	4·8	21·0	12·2	12·4	„ moderately worn.
St. Gilles, Gard	172105	♂	36·2	12·6	17·2	10·0	8·6	5·2	23·6	13·0	13·2	„ much worn.
Germany: Brunswick	85256	♂	34·2	11·6	16·0	10·0	8·2	4·8	21·6	11·4	12·4	„ moderately worn.
„	85258	♂	33·8	11·6	16·0	9·8	7·8	4·6	21·4	12·2	12·8	„ slightly worn.
„	85262	♂	36·2	12·2	17·0	10·2	8·0	4·8	23·6	13·6	13·8	„ moderately worn.
„	85263	♀	37·8	12·6	17·2	10·2	8·8	5·4	24·4	13·8	14·0	„ much worn.
„	85265	♀	35·0	12·4	16·8	10·6	8·4	4·6	22·4	13·0	13·2	„ slightly worn.
„	85266	♀	36·6	12·4	16·4	10·2	8·0	5·2	23·2	13·6	13·4	„ moderately worn.
Königsberg	112259	♂	36·2	12·6	17·6	9·8	8·4	5·2	23·0	13·2	13·4	„ „
„	112260	♂	34·6	12·2	16·2	10·4	7·6	5·0	22·4	12·8	13·2	„ slightly worn.
„	112261	♂	34·2	11·2	16·6	10·2	8·0	5·0	22·2	13·2	13·2	„ „
„	112262	♂	35·8	12·6	16·6	10·0	8·2	5·0	23·2	13·4	13·2	„ „
Ingelheim, Rheinhessen	8. 11. 2. 11	♂	34·2	11·6	16·2	10·0	7·8	4·4	22·0	12·8	13·0	„ moderately worn.
Strassburg	152369	♀	34·0	11·6	16·0	9·2	7·6	4·4	21·6	12·4	12·6	„ „
„	8. 8. 10. 10		35·0	12·2	16·8	10·4	8·2	4·8	22·6	12·6	13·0	„ not worn.
„	8. 8. 10. 11		33·0	11·2	16·2	10·0	8·0	4·6	21·2	12·2	12·6	„ „
Roumania: Bustenari	4. 4. 6. 13	♂	34·2	12·0	16·6	10·0	8·4	5·0	22·0	12·8	12·6	„ moderately worn.
Comana	4. 4. 6. 14	♂	34·6	12·0	16·6	9·2	8·6	5·0	22·4	13·0	13·2	„ slightly worn.
Bulgaria: Sofia	Andersen	♀ ?	34·0	12·4	16·2	9·8	8·2	4·8	22·2	13·2	13·0	„ much worn.
Switzerland: Lausanne, Vaud	102274	♂	34·6	11·8	16·0	9·6	8·2	4·8	22·0	12·8	12·8	„ moderately worn.
Les Plans „	104485	♂	34·0	11·4	16·2	9·6	7·8	4·8	21·4	12·2	12·4	„ slightly worn.
St. Gallen	4. 4. 5. 23	♂	33·2	11·4	15·8	9·8	8·0	4·6	21·2	12·2	12·2	„ „
„	4. 4. 5. 24	♂	33·2	—	15·4	9·8	8·0	4·8	21·6	12·2	12·4	„ „
„	4. 4. 5. 25	♀	33·0	—	15·4	9·6	7·8	4·4	21·2	12·4	12·8	„ „
„	105798	♂	33·0	11·4	16·0	9·8	8·0	4·6	21·2	12·2	12·0	„ „
Andermatt, Uri	85745	♀	33·8	—	16·0	9·6	8·0	4·8	21·8	12·6	13·0	„ „
Comano, Ticino	121211	♀	34·6	12·4	17·0	10·2	8·4	5·2	22·6	13·0	13·0	„ „
Cortivallo „	121208	♀	34·0	12·0	16·4	9·8	8·2	5·2	22·2	12·8	13·0	„ „
„ „	121209	♀	35·2	12·8	17·2	10·6	8·6	5·0	23·2	13·2	13·2	„ moderately worn.
Lugano „	121206	♀	35·0	12·8	17·0	10·8	8·6	5·0	23·0	13·2	13·6	„ slightly worn.
„ „	121220	♂	34·0	12·2	16·6	10·0	8·2	5·0	22·4	13·0	13·0	„ not worn.
Muzzano „	115271	♂	33·8	12·0	16·4	10·4	8·2	4·8	22·4	12·8	13·2	„ moderately worn.

CRANIAL MEASUREMENTS OF *TALPA EUROPAEA* *continued.*

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Breadth of brain-case.	Depth of brain-case through bulla.	Greatest interorbital breadth.	Rostral breadth over canines.	Mandible.	Maxillary tooth-row (exclusive of incisors).	Mandibular tooth-row (entire: alveoli).	Observations.
Italy: near Turin	152137	♂	33·6	12·2	16·6	10·2	8·4	5·0	22·0	13·2	13·2	Teeth slightly worn.
,, ,,	152139	♂	36·2	13·0	17·2	10·8	8·0	5·2	23·6	13·6	13·8	,, not worn.
Parma	152141	♂	33·6	12·2	16·6	10·0	8·4	5·0	22·2	13·0	13·2	,, slightly worn.
,,	152142	♂	34·6	12·2	16·2	10·8	8·0	4·6	22·6	13·0	13·2	,, not worn.
Florence	105384	♂	34·2	12·2	16·6	10·2	7·8	5·0	22·0	12·8	13·0	,, slightly worn.
,,	105386	♂	36·2	12·8	17·0	10·4	8·0	5·2	23·4	13·4	13·4	,, ,,
,,	105390	♂	35·0		16·4	10·2	8·2	5·0	22·6	13·2	13·2	,, ,,
,,	105385	♀	33·8	12·2	16·2	9·8	8·0	4·8	22·0	12·8	12·8	,, moderately worn.
,,	105387	♀	34·0	12·2	16·6	10·0	7·8	4·6	21·6	13·0	12·8	,, slightly worn.
Spain: Pajáres, Leon	8. 2. 9. 26	♂	36·0	12·4	17·0	11·0	8·4	4·8	23·6	13·0	13·2	,, ,,
,, ,,	8. 2. 9. 27	♀	35·6	12·0	16·6	10·0	8·4±	5·0	23·6	13·0	12·8	,, much worn.
Castrillo de la Reina, Burgos	8. 7. 7. 1	♂	36·0	—	17·6	10·0	8·4	5·0	23·0	13·2	13·0	,, moderately worn.
,, ,, ,,	8. 7. 7. 2	♂	34·2	11·6	16·0	10·4	8·0	4·8	22·0	12·8	13·2	,, not worn.
,, ,, ,,	8. 7. 7. 3	♀	33·8	11·8	16·4	10·0	8·0	4·8	22·0	12·8	13·0	,, slightly worn.
,, ,, ,,	8. 7. 7. 4	♀	34·2	12·0	16·8	10·2	8·0	4·8	22·4	13·0	13·0	,, ,,
Barracas, Castellon	8. 2. 9. 27	♂	36·6	12·6	17·6	11·0	8·4	5·0	23·8	13·4	13·6	,, ,,
,, ,,	8. 2. 9. 29	♂	35·4	12·2	17·2	10·6	8·2	5·0	23·0	13·2	13·6	,, ,,
,, ,,	8. 2. 9. 31	♂	36·0	12·6	17·4	10·0	8·6	5·0	23·4	13·2	13·6	,, much worn.
,, ,,	8. 2. 9. 32	♂	37·0	13·0	17·4	11·0	8·6	5·2	24·2	13·6	13·8	,, slightly worn.
,, ,,	8. 2. 9. 35	♀	33·6	11·4	15·8	9·6	7·8	4·8	22·0	12·4	13·0	,, ,,
,, ,,	8. 2. 9. 36	♀	34·0	11·0	16·0	10·2	8·2	4·8	22·2	13·0	13·2	,, ,,
,, ,,	8. 2. 9. 39	♀	33·2	12·0	16·2	10·2	8·2	4·8	21·8	12·6	13·0	,, moderately worn.
,, ,,	8. 2. 9. 40	♀	34·0	11·8	16·8	10·2	8·0	4·8	21·6	12·6	13·0	,, slightly worn.
Dehesa de Valencia, Valencia	8. 2. 9. 17	♂	36·4	12·6	17·2	10·6	8·4	5·2	23·6	13·4	13·6	,, not worn.
,, ,,	8. 2. 9. 18	♂	35·1	12·2	17·2	10·0	8·0	5·0	23·0	12·8	13·2	,, moderately worn.
,, ,,	8. 2. 9. 19	♂	36·0	12·4	17·6	11·0	8·6	5·0	23·0	13·2	13·4	,, not worn.
,, ,,	8. 2. 9. 20	♂	35·6	12·4	17·0	10·4	8·2	5·0	22·4	13·0	13·0	,, ,,
,, ,,	8. 2. 9. 23	♀	33·6	11·8	16·2	10·4	8·0	4·8	21·0	12·4	12·8	,, slightly worn.
,, ,,	8. 2. 9. 24	♀	34·6	12·4	16·2	9·8	8·0	5·0	22·4	13·2	13·0	,, much worn.
,, ,,	8. 2. 9. 25	♀	33·6	12·0	16·0	10·2	8·0	4·8	21·8	12·4	13·0	,, not worn.
Catarroja	8. 2. 9. 12	♂	35·8	12·2	17·0	10·4	8·2	5·0	23·6	13·2	13·4	,, slightly worn.
,, ,,	8. 2. 9. 13	♂	36·2	12·2	17·2	10·2	8·2	5·0	23·6	13·6	13·6	,, ,,

TALPA CÆCA Savi.

1822. *Talpa cæca* Savi, Nuovo Giorn. de' Letterati, Pisa, I, p. 265.
1857. *Talpa cæca* Blasius, Säugethiere Deutschlands, p. 115.
1906. *Talpa cæca* Camerano, Boll. Mus. Zool. ed Anat. Comp. della R. Univ. di Torino, XXI, No. 530, p. 1, June 22, 1906.
1910. *Talpa cæca* Trouessart, Faune Mamm. d'Europe, p. 63.

Type locality.—Mountains near Pisa, Italy.

Geographical distribution.—Mediterranean region, eastward into Asia Minor; details of distribution not known.

Diagnosis.—Smaller than *Talpa europæa* (condylobasal length of skull, 29–32 mm. instead of 33–37 mm.) and skull with narrower rostrum and palate (breadth of rostrum over canines about 4 mm. instead of 4·6–5 mm.); temporal fossa shortened, the distance from its posterior margin to posterior margin of anteorbital foramen about equal to distance from latter point to second premolar; anteorbital foramen large, its posterior border over front of last molar, the plate forming outer wall of canal a slender, terete thread; teeth small, the length of upper tooth-row (exclusive of incisors), 11–12 mm.; mesostyle of m^2 and m^3 with apex deeply notched (this character not visible in specimens with much worn teeth).

Measurements. Average and extremes of five specimens from Cortivallo, Ticino, Switzerland: head and body, 133·8 (125–142); tail, 25·2 (21–30); hind foot (dry), 15·6 (15–16). Average and extremes of three specimens from Reggello, Tuscany, Italy (in alcohol): tail, 23·6 (22–25); hind foot, 14·7 (14·4–15·5). For cranial measurements see Table, p. 17.

Specimens examined.—Twenty-five, from the following localities:—
SWITZERLAND: Agmizzo, Ticino, 1; Bellinzona, Ticino, 1 (U.S.N.M.); Breganzona, Ticino, 1 (U.S.N.M.); Canabbio, Ticino, 1 (U.S.N.M.); Cortivallo, Ticino, 5 (U.S.N.M.); Lonvico, Ticino, 2 (U.S.N.M.); Lugano, Ticino, 3 (U.S.N.M.); Muzzano, Ticino, 1 (U.S.N.M.); Origlio, Ticino, 1 (U.S.N.M.); Sorengo, Ticino, 1 (U.S.N.M.); Stabio, Ticino, 1.
ITALY: Regello, Tuscany, 4 (U.S.N.M.); N.S. della Vittoria, Ligurian Appenines, 1 (Genoa); no exact locality, 2.

♂.	Agmizzo, Ticino, Switzerland. (*E. H. Zollikofer.*)	O. Thomas (P).	2. 8. 4. 18.
♂.	Stabio, Ticino. (*E. H. Zollikofer.*)	O. Thomas (P).	2. 8. 4. 19.
♂, ♀ al.	Italy.	Dr. Rüppell (C).	45. 7. 22. 32–33.

TALPA OCCIDENTALIS Cabrera.

1907. *Talpa cæca occidentalis* Cabrera, Ann. and Mag. Nat. Hist., 7th ser., XX, p. 212, September, 1907. Type in Cabrera collection.
1907. *Talpa cæca occidentalis* Cabrera, Bol. Real. Soc. Espan. Hist. Nat., Madrid, VII, p. 222, October, 1907. (For date see Cabrera, Ann. and Mag. Nat. Hist., 8th ser., I, p. 189, February, 1908.)
1910. *Talpa cæca occidentalis* Trouessart, Faune Mamm. d'Europe, p. 63.

Type locality.—La Granja, Province of Segovia, Spain.

Geographical distribution.—Iberian Peninsula.

Diagnosis.—Like *Talpa cæca* but skull rather robust, the breadth of rostrum over roots of canines usually more than 4 mm.; anteorbital foramen contracted, its posterior border over mesostyle of m^2, the plate forming outer wall of canal usually as wide as transverse diameter of foramen; crowns of molars appreciably enlarged (length of upper tooth-row, exclusive of incisors, frequently more than 13 mm.), but dentition otherwise as in *Talpa cæca*.

Skull.—The skull is somewhat larger and more robust than that of *Talpa cæca*, a character particularly noticeable in the greater width of rostrum and palate. In details of structure, however, it shows no striking peculiarities except in the form and position of the anteorbital foramen. This foramen is noticeably smaller than in *Talpa cæca*, and its posterior border lies over middle or front of second molar instead of over front of third. The plate forming outer wall of canal is wider and less thread-like than in *Talpa cæca*. Zygoma about as long as in *Talpa cæca*, but owing to the different position of posterior border of anteorbital foramen, the distance from this point to posterior edge of temporal fossa equals that from foramen to canine, or even in one exceptional instance, to outer incisor.

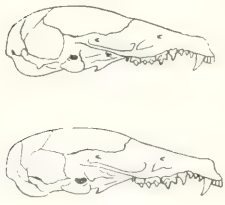

FIG. 3.
Talpa cæca (upper figure), and *T. occidentalis* (lower figure). Nat. size.

Teeth.—The upper molars are distinctly larger than those of *Talpa cæca*, but otherwise the teeth show no peculiarities.

Measurements.—Type (from Cabrera): head and body, 102; tail, 24; hind foot, 15·5. Average and extremes of five specimens from La Granja, Segovia, Spain (in spirit, body contracted): head and body, 101·6 (98–107); tail, 25·6 (25–27); hind foot, 16·4 (16–17). Adult male from Galicia: head and body, 112; tail, 26; hind foot, 15·4. Two males from Cintra, Portugal: head and body, 118 and 120; tail, 26 and 26; hind foot, 16 and 17. For cranial measurements see Table, p. 17.

Specimens examined.—Ten, from the following localities:—
SPAIN: Galicia, 1; La Granja, Segovia, 5.
PORTUGAL: Cintra, 4.

1 al.	Galicia, Spain.	Prof. Seoane (C & P).	94. 1. 1. 23.
2 ♂, 2 ♀ al.	La Granja, Segovia, Spain.	M. de la Escalera (C).	8. 7. 30. 19-22.
Skull.	La Granja, Segovia.	M. de la Escalera (C).	6. 11. 4. 2.
2 ♂, 1 al.	Cintra, Portugal.	O. Thomas (C & P).	98. 2. 2. 8 9, 58, 59.
1 skull.			

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Breadth of brain-case.	Depth of brain-case through bulla.	Greatest interorbital breadth.	Breadth of rostrum over canines.	Mandible.	Maxillary tooth-row (exclusive of incisors).	Mandibular tooth-row (entire; a. vveoli).	Observations.
Talpa cæca.												
Switzerland: Stabio, Ticino	2. 8. 4. 18	♂	31·0	11·2	15·8	9·8	7·2	4·0	20·2	12·0	12·0	Teeth not worn.
Agmizzo	2. 8. 4. 19	♂	30·0	10·2	15·0	9·8	6·8	3·8	19·8	11·8	11·8	,, ,,
Bellinzona	121210	♀	30·4	10·2	15·0	10·0	7·0	3·8	20·0	11·6	11·8	,, ,,
Breganzona	115273	♀	31·8	10·6	16·2	9·6	7·2	4·0	20·2	12·0	11·6	,, slightly worn.
Cortivallo	115268	♂	30·2	10·0	14·8	9·2	7·2	3·8	19·6	11·6	11·6	,, moderately worn.
,,	121214	♂	30·8	11·0	15·0	9·8	7·0	3·8	20·0	11·8	11·8	,, not worn.
,,	121218	♂	30·8	10 6	—	—	6·8	3·8	20·0	11·8	11·6	,, slightly worn.
Lonvico	121212	♂	30·4	10·6	15·0	8·8	7·2	4·0	19·8	11·8	11·8	,, moderately worn.
Lugano	121217	♂	31·6	11·2	15·2	10·0	7·2	4·2	20·4	11·8	12·2	,, not worn.
,,	121216	♂	30·2	10·6	14·8	9·2	7·0	4·0	19·6	11·6	11·8	,, slightly worn.
Muzzano	115270	♀	31·2	—	15·6	9·6	7·0	4·2	20·4	12·0	11·8	,, ,,
Origlio	115215	♂	30·2	10·6	15·0	8·8	7·0	4·0	19·8	11·8	11·8	,, much worn.
Sorengo	115274	♂	31·4	11·0	15·4	9·0	7·4	4·2	20·4	12·0	11·8	,, moderately worn.
Italy: no exact locality	45.7.22.32		30·0	10·2	14·8	9·2	7·0	4·0	19·2	11·2	11·2	,, ,,
,, ,, ,,	45.7.22.33		30·8	10·8	15·0	9·6	7·0	4·0	20·0	12·0	12·0	,, slightly worn.
Reggello, Tuscany	152152	♂	29·2	9·8	14·8	9·2	7·0	3·6	18·8	11·6	11·8	,, not worn.
Talpa occidentalis.												
Spain: La Granja, Segovia	6. 11. 4. 2		30·0	11·6	15·8	9·2	7·2	4·4	20·0	11·8	12·0	,, slightly worn.
,, ,,	8. 7. 30. 19	♂	32·0	12±	16·0	10·0	7·4	4·6	21·0	13·0	13·0	,, ,,
,, ,,	8. 7. 30. 20	♀	31·4	11·6	15·4	10·0	7·6	4·2	21·0	12·2	12·4	,, ,,
,, ,,	8. 7. 30. 21	♂	32·0	12·0	15·8	9·4	7·6	4·6	21·0	12·2	12·6	,, ,,
,, ,,	8. 7. 30. 22	♀	31·2	11·8±	15·2	9·2	7·2	4·2	20·4	12·2	12·2	,, ,,
Portugal: Cintra	98. 2. 2. 8	♂	30·2	11·0	14·6	9·4	7·0	4·0	20·0	11·8	12·0	,, ,,
,,	98. 2. 2. 9	♂	31·2	11·0	15·0	9·6	7·0	4·0	20·2	12·0	12·0	,, ,,
,,	98. 2. 2. 59	♂ juv.*	30·0	—	14·4	8·4	6·8	3·8	19·0	11·4	11·4	,, not worn.
,,	152377	♂ yg. / ♂ ad.	28·6	10·8	14·2	8·4	6·4	4·0	19·0	11·0	11·6	,, ,,

* Permanent dentition not fully in place.

TALPA ROMANA Thomas.

1902. *Talpa romana* Thomas, Ann. and Mag. Nat. Hist., 7th ser., x, p. 517, December, 1902. Type in British Museum.
1904. *Talpa romana* Camerano, Mem. Reale Accad. Sci. di Torino, 2nd ser., LIV, p. 81.
1910. *Talpa romana* Trouessart, Faune Mamm. d'Europe, p. 64.

Type locality.—Ostia, Rome, Italy.

Geographical distribution.—Vicinity of Rome, Italy.

Diagnosis.—Externally similar to *Talpa europæa* but a trifle larger; skull and dentition more robust than in the related animal (greatest diameter of m^1 about 4 mm.; length of upper tooth-row, exclusive of incisors, 14 to 15 mm.); mesostyle of all three upper molars bifid at tip.

Skull and teeth.—Except that it is rather more robust the skull does not differ appreciably from that of *Talpa europæa*, though posterior base of zygoma appears to be usually situated somewhat further back. Teeth as in *Talpa europæa*, but larger throughout, a difference particularly noticeable in the first upper molar and in the large lower cheek-teeth (the combined length of

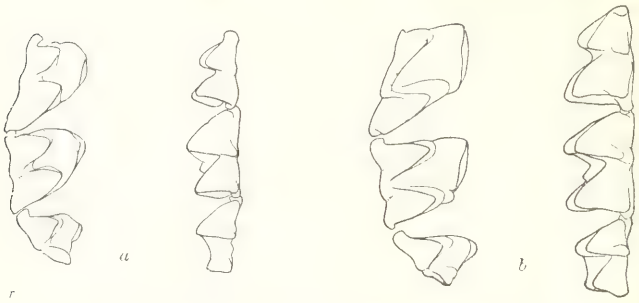

FIG. 4.
Crown of molars in *Talpa europæa* (*a*), and *T. romana* (*b*). × 5.

these four teeth about 10 mm. instead of about 8 mm.). In form the teeth are similar to those of the related animal, but the mesostyle of m^1 is relatively as well as actually larger, and its tip is distinctly bifid, though not so deeply as in the succeeding teeth. Cingulum between outer bases of main cusps of lower molars better developed than in *T. europæa*, its edge frequently forming an evident cusp, especially in m_2.

Measurements.—External measurements of type (from Thomas): head and body, 126; tail, 29; hind foot, 19 (all measurements from skin). Four males from the vicinity of Rome (in alcohol): head and body, 138·3 (130–145); tail, 28·6 (27–30); hind foot, 19·6 (19–20). Three females from the same

CRANIAL MEASUREMENTS OF *TALPA ROMANA*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Breadth of brain-case.	Depth of brain-case through bulla.	Greatest interorbital breadth.	Breadth of rostrum over canines.	Mandible.	Maxillary tooth-row (exclusive of incisors).	Mandibular tooth-row (entire: alveoli).	Observations.
Italy: Ostia, Rome . .	1. 1. 2. 8*	♂?	35·6	14·8	17·6	10·8	8·0	5·2	25·0	14·2	14·8	Teeth slightly worn.
Frascati „ . .	1. 1. 2. 9	?	35·0	14·2	17·4	10·8	7·8	5·2	25·0	14·4	14·4	„ „
Rome . . .	3. 1. 31. 2	♀	34·0	13·2	17·0	10·4	7·8	5·2	23·6	14·0	14·8	„ ? „
„ . . .	11. 1. 2. 1	♂	35·4	14·0	17·6	10·8	8·0	5·2	24·0	14·2	14·8	„ much worn.
„ . . .	11. 1. 2. 2	♂	34·2	14·0	—	—	7·6	5·2	24·0	14·0	14·4	„ not worn.
„ . . .	152375	♂	35·0	13·6	17·4±	10·4±	7·6	5·0	24·0	14·6	14·4	„ „
„ . . .	152376	♂	35·4	—	17·0	10·0	8·0	5·0	24·4	14·2	14·6	„ moderately worn.
„ . . .	152145	♂	37·6	14·2	18·4	10·4	8·0	5·4	26·2	15·0	15·2	„ „
„ . . .	152146	♂	37·2	14·6	18·2	11·0	8·2	5·4	25·8	14·8	15·2	„ „
„ . . .	152147	♀	35·4	13·6	17·2	10·0	7·8	5·2	24·6	14·2	14·2	„ much worn.
„ . . .	152148	♂	36·4	13·8	17·6	11·0	8·0	5·4	25·2	14·8	14·8	„ moderately worn.
„ . . .	152149	♀	36·2	14·0	—	10·4	8·0	5·2	25·2	15 0	15·0	„ slightly worn.
„ . . .	152150	♂	37·0	14·2	17·6	10·4	7·4	5·4	26·0	14·6	15·2	„ „
„ . . .	152151	♀	35·8	13·6	—	—	7·8	5·2	25·2	14·4	14·6	„ „

* Type.

locality: head and body, 127·5 (125–130); tail, 29·5 (29–30); hind foot, 18·4 (18–18·6). For cranial measurements see Table, p. 19.

Specimens examined.—Fourteen, from the vicinity of Rome (B.M. and U.S.N.M.); also about fifty from the same region in Turin Museum.

Remarks.—Talpa romana is a well characterized species, readily distinguished from other European moles by its unusually large teeth.

1.	Ostia, Rome.	Dr. L. Sambon (c & p).	1. 1. 2. 8. (*Type* of species.)
1.	Frascati, Rome.	Dr. L. Sambon (c & p).	1. 1. 2. 9.
♂, ♀ al.	Rome.	Genoa Museum (e).	3. 1. 31. 1–2.
2 ♂.	Rome. (*C. Coli.*)	G. Barrett-Hamilton (p).	11. 1. 2. 1–2.

SUB-FAMILY DESMANINÆ.

Geographical distribution.—South-western France and northern half of Iberian Peninsula; eastern Russia and western Siberia.

Characters.—Teeth in front of molars not differentiated by form into incisors, canines, and premolars; anterior upper incisor greatly enlarged, canine-like, directed downward, its outer edge highly trenchant, the two anterior lower incisors slightly elongated, projecting obliquely forward; external form less evidently mole-like than in the *Talpinæ*, modified for aquatic life, the much enlarged hind feet with completely webbed toes, the front feet smaller, not peculiar in form; tail long; muzzle depressed.

Remarks.—The sub-family *Desmaninæ* contains the genera *Desmana* of Russia and Siberia, and *Galemys* of the Iberian Peninsula and south-western France, strictly aquatic animals not distantly related to the American moles. The anterior teeth present a much higher degree of specialization than that met with in the *Talpinæ*.

Genus **GALEMYS** Kaup.

1829. *Galemys* Kaup, Entw.-Gesch. u. Natürl. Syst. Europ. Thierwelt, I, p. 118 (*Mygale pyrenaica* Geoffroy).

1846. *Galomys* Agassiz, Nom. Zool., Index Univ., p. 149 (Emendation of *Galemys*).

1849. *Mygalina* I. Geoffroy, D'Orbigny's Dict. Univ. d'Hist. Nat., IV, p. 709 (*Mygale pyrenaica* Geoffroy).

Type species. *Mygale pyrenaica* Geoffroy.

Geographical distribution.—Northern half of Iberian Peninsula, and Pyrenean region of south-western France.

Characters.—Tail flattened laterally at distal extremity, elsewhere terete; unicuspid teeth slender, their width conspicuously less than height of crown; main cusp of large premolar trenchant anteriorly; brain-case without unusual ridges.

Remarks.—The genus *Galemys* is readily distinguishable from the Russian and Siberian *Desmana*,* in which the tail is flattened laterally throughout, the unicuspid teeth are low and thick, their width about equal to height of crown, the main cusp of large premolar is rounded anteriorly, and the ridges on brain-case are unusually developed. It contains a single species, peculiar to south-western Europe.

GALEMYS PYRENAICUS Geoffroy.

(Synonymy under subspecies.)

Geographical distribution.—South-western France (Pyrenees and their immediate neighbourhood) and northern half of Iberian Peninsula.

Diagnosis.—General characters as in the genus; head and body, 110 to 135; tail, 130 to 155; hind foot, 32·5 to 38; condylobasal length of skull, 33 to 35·5; mandible, 22 to 24.

External characters.—Form somewhat intermediate between that of a mole and rat, the body less elongated than in *Talpa*, but the neck almost equally short (so that auditory orifice appears to be at shoulder) and the muzzle similarly produced; legs less shortened than in the moles and front feet not specially enlarged; tail rat-like, longer than head and body. Fur less dense and velvety than in the moles, and of the peculiar quality characteristic of aquatic mammals, the hairs of two kinds, the longer, coarser ones about 12 mm. in length, those of shorter under fur about half as long. Head conical, as in the moles, but the much elongated snout (length about 20 mm. from incisors) greatly flattened instead of terete, its breadth at middle about 7 mm., depth in same region 2 mm. At tip the muzzle broadens rather abruptly to about 10 mm., the broadened portion divided by shallow notch at middle of anterior border into two slightly indicated lobes; at middle of each lobe and about 1 mm. back from anterior edge is situated one of the rather large, transversely elongated nostrils.† The median

* The synonymy of this genus is as follows:—

1777. *Desmana* Gueldenstaedt, "Beschäft. Berliner Gesellsch. Naturforsch. Freunde, III, p. 108." (*Castor moschatus* Linnæus.)
1799. *Desman* Lacépède, Tabl. Mamm., p. 7. Same type.
1800. *Mygale* Cuvier, Lec. d'Anat. Comp., I, Tabl. I. Same type. (Described in Tabl. Elém. d'Hist. Nat. des Anim., p. 109.)
1815. *Desmanus* Rafinesque, Analyse de la Nature, p. 59 (Emendation of *Desman*).
1829. *Myogalea* Fischer, Synops. Mamm., p. 250 (Substitute for *Mygale*).
1830. *Caprios* Wagler, Nat. Syst. Amphibien, p. 14 (Substitute for *Mygale*).
1836. *Myogale* Brandt, Wiegmann's Archiv für Naturgesch., 1834, I, p. 176.

† The actual narial opening is situated at extreme inner portion of nostril, and is capable of complete closure by the combined action of antero-internal border of nostril, a narrow semilunar membrane at upper edge of inner narial aperture, and a large wart-like thickening of upper border of nostril.

notch is continued backward on upper surface as a narrow groove still further dividing the two lobes: on under side it is continuous with a similar though much longer groove extending to middle of upper lip. Each lobe is further marked by a narrow groove extending backward and slightly inward from near outer edge of nostril. Surface of lobes very finely rugose and pitted, that of rest of muzzle coarsely rugose and without pits. Behind lobes the muzzle is naked along median region, thinly haired at sides and beneath. Eye minute, essentially as in *Talpa*, though probably never covered by the integument. No external ear, the meatus about 4 mm. in diameter. Front feet rather large and broad, readily turned outward but not permanently in this position, the five short fingers joined by a narrow web, and armed with strong, slightly curved claws 4 to 5 mm. in length; fourth digit longest, fifth and third sub-equal and slightly shorter, second and first still shorter. Palms naked, their surface finely tuberculo-rugose, without trace of larger tubercles, though the surface is marked by three deep wrinkles; balls of digits projecting conspicuously beneath bases of claws. Dorsal surface of front foot covered with minute hairs, these lengthening along edges to form distinct fringes. Hind foot much larger than front foot, the toes webbed to base of claws, the claws similar to those on front foot but larger; fourth digit longest, third, fifth, second and first successively shorter, the first extending nearly to end of first phalanx of second; surface of sole like that of palm, the three longitudinal wrinkles at bases of digits well developed, the large inner tubercle present in the moles very slightly developed, its extremity not projecting like a supplemental digit. Upper surface of hind foot naked, somewhat more coarsely tuberculate than sole. A fringe of stiffened hairs along outer edge of outer toe and continuing along foot nearly to heel. Tail longer than head and body, terete except at tip, where it is flattened laterally. Scales arranged in somewhat irregular rings, of which there are about nine to the centimeter at middle of tail. Hairs of tail short, not concealing scales except on flattened terminal portion, where they form

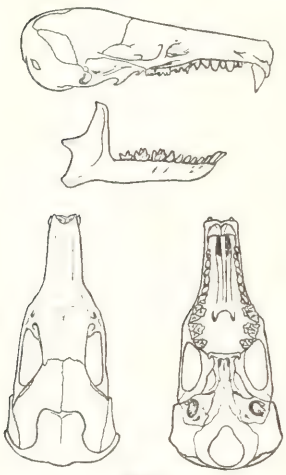

FIG. 5.

Galemys pyrenaicus. Nat. size.

a rudimentary dorsal and ventral keel. Mammæ: p 1 – 1, a 1 – 1, i 2 – 2 = 8.

Colour.—Back and sides dark brown varying somewhat in exact shade, but never a distinct slaty as in *Talpa*, the longer hairs lighter than the under fur and sometimes producing a slight effect of coarse "lining," particularly on posterior third of back and along sides. Under parts buffy in rather strong contrast with back, but without true line of demarcation. Hairs of tail and feet buffy. Claws whitish.

Skull.—In general the skull resembles that of *Talpa europæa*, but the brain-case is shorter and squarely truncate posteriorly, the interorbital region is shorter and narrowed instead of widened at middle, and the rostrum is longer. Surface of skull smooth except for the same ridges as in *Talpa*, those at sides of brain-case not unusually developed. Brain-case decidedly more than half as deep as wide, its outline when viewed from behind vaguely pentagonal, its posterior margin nearly straight, though with slight median swelling; condyles not projecting posteriorly, completely hidden when viewed from above. Interparietal projecting further forward than in *Talpa*, its antero-posterior diameter nearly equal to its width. Base of brain-case with deep but broad median furrow, the surface of the bones more angular and less inflated than in *Talpa;* no pits in basioccipital in front of foramen magnum. Bullæ low and flattened, less perfectly formed than in *Talpa*, the tympanic bone annular and retaining its distinctness, though joined with surrounding parts; meatus large, occupying about one-half surface of bulla. Mesopterygoid space short, its length scarcely equal to width of palate between posterior molars, its width about one-third length, its anterior border double rounded, encroached on by slight median spine. Outer pterygoid plate reduced to a small but evident ridge. Interorbital region hour-glass shaped, widening more rapidly posteriorly than anteriorly, its narrowest region slightly behind middle. Zygoma straight, flattened posteriorly, compressed anteriorly, its length (measured from posterior border of orbit to posterior border of anteorbital foramen) equal to distance from posterior border of anteorbital foramen to front of canine. Rostrum about as wide as in *Talpa*, but relatively longer, the distance from posterior border of anteorbital foramen to gnathion about equal to greatest breadth of brain-case instead of much less, its dorsal surface on level with that of interorbital region, its outer margins nearly parallel to the squarely truncate anterior extremity. Nares scarcely emarginate posteriorly. Anterior portion of border of alveolus of large incisor distinctly thickened, the thickened region terminating laterally in a small but evident wart-like nodule. Lachrymal foramen over middle of anteorbital foramen and middle of m^1. Posterior border of anteorbital foramen over parastyle of m^2. Palate essentially as in *Talpa*, but vacuities smaller and incisive foramina large, their

longitudinal diameter about equal to width of palate in same region. Posterior palatal ridge much as in *Talpa*, but the extremities produced as distinct backward-curved processes. Mandible rather robust, the ramus nearly straight, the angular process much below alveolar line. Coronoid process high and narrow, slightly recurved at tip, its height above alveolar line considerably greater than least breadth of posterior segment of mandible. Articular process short and robust, the single articular surface rather large, normal in position. Angular process longer than articular process, its form essentially as in *Talpa*.

Teeth. Dentition relatively heavier than in *Talpa europæa*, the teeth, with exception of anterior upper incisors, less trenchant in general aspect. Anterior upper incisor much the largest of all the teeth, the two together closing entire front of palate; shaft triangular in cross section, and all three faces sub-triangular in outline, the posterior and antero-external faces widest, the former slightly concave, the latter slightly convex, the two forming a perpendicular external cutting edge about 4 mm. in length along their line of contact; a much shorter but well developed cutting edge along line of contact of posterior and antero-internal faces, extending from acutely triangular-pointed apex of tooth to point of contact with tooth of opposite side, a distance of about 0·6 mm.; line of contact between antero-external and antero-internal faces marked by a slight though evident ridge; height of shaft about equal to width of palate; first and second lower incisors small, chisel-shaped, strongly imbricated, the second about twice as large as first, their shafts directed forward in line with upper portion of symphysis menti, the tips of the four teeth together forming a straight transverse cutting edge which

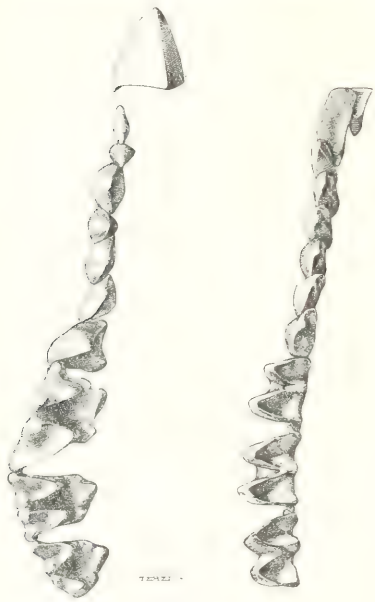

FIG. 6.

Galemys pyrenaicus. Teeth × 5.

acts in opposition to combined posterior surface of large upper incisors. Upper unicuspids forming an unbroken row continuous posteriorly with series of cheek teeth, but separated anteriorly from large incisor by distinct space into which the apex of second lower incisor fits when jaws are closed. Two anterior unicuspids (i^2 and i^3) minute, terete, single-rooted, their axes directed backward and falling in same line with those of two anterior lower unicuspids when jaws are closed. Third unicuspid (canine) two-rooted, its crown perpendicular, compressed, larger than those of first and second combined, and distinctly greater in height. Fourth unicuspid (pm^1) single-rooted, subterete, scarcely larger than second. Fifth and sixth unicuspids (pm^2 and pm^3) essentially like canine, their crowns distinctly higher than wide, compressed obliquely to the tooth-row, with slightly developed anterior and posterior cutting edge. Height of third and fifth sub-equal, greater than in the others, their tips about on level with main cusps of molars; sixth lower than fifth but with crown longer and posterior ridge better developed. Lower unicuspids not unlike pm^2 and pm^3 but with crowns lower and longer, slanting a little forward, each with a faintly developed antero-internal lobule. These teeth are slightly imbricated and their form approximates that of the unicuspids of the *Soricidæ*. First and second (i_3 and $_4$) higher than third, their form suggesting that of anterior lower incisor, all three single-rooted. Fourth larger than any of the first three, obscurely two-rooted; fifth slightly smaller, single-rooted; sixth (pm_4) largest of the series, distinctly two-rooted, its cusp nearly on level with main cusps of molars, its antero-external lobule (rudiment of parastyle) more evident than in the others. Large upper premolar three-rooted, its crown area about equal to that of third molar, its main cusp with well developed anterior and posterior cutting edges, its antero-internal cusp small but evident, its postero-internal cusp about equal to protocone of m^3. Upper molars with crowns wider and less oblique than in *Talpa europæa*, and main cusps not so high. Transverse groove between bases of main cusps converted into a median pit by better development of commissures of protocone and larger size of protoconule and metaconule. Paracone and metacone about equal in height, the latter slightly the more robust. Styles well developed, except the reduced parastyle of m^1, the mesostyle in each tooth completely divided into two cusps, the W-pattern thus changed into two V-shaped figures. Third upper molar with crown area about two-thirds that of second, its metastyle and fourth commissure absent. Lower molars essentially as in *Talpa europæa*, but contrast in height of outer and inner cusps very slight.

Galemys pyrenaicus pyrenaicus Geoffroy.

1811. *Mygale pyrenaica* Geoffroy, Ann. Mus. d'Hist. Nat., Paris, xvii, p. 193.
1910. *Myogale pyrenaica* Trouessart, Faune Mamm. d'Europe, p. 60.

Type locality.—Near Tarbes, Hautes-Pyrénées, France.

Geographical distribution.—Pyrenees and adjacent portion of southern France; probably also north-eastern Spain to the Ebro; Asturias?

Diagnosis.—Hind foot, 32·4 to 34·6 mm.; condylobasal length of skull about 33 to 34 mm.

Colour.—Back and sides intermediate between prouts-brown and seal-brown, the longer hairs not so dark as under fur and with a conspicuous lustre; a small ill-defined buffy area around eye. Underparts varying from ochraceous buff to a dull light cream-buff, clouded by slaty under colour. Front feet dull ochraceous-buff tinged with dark brown. Hairs of tail and fringe on hind foot light buffy.

Measurements.—Two males from Ax-les-Thermes, Ariège, France: head and body, 115 and 130; tail, 134 and 137; hind foot, 34·6 and 34. Average of three females from the same locality: head and body, 117 (110–133); tail, 131·6 (126–137); hind foot, 32·9 (32·4–34). For cranial measurements see Table, p. 27.

Specimens examined.—Fifteen, from the following localities:—
France: Ax-les-Thermes, Ariège, 5; Pyrenees, no exact locality, 8 (B.M. and U.S.N.M.).
Spain: Pajáres, Leon, 2.

2 al.	Ax-les-Thermes, Ariège, 720 m. France.	Toulouse Museum (p).	1. 7. 27. 1–2.
♂, ♀.	Ax-les-Thermes, Ariège.	V. Builles (p).	8. 3. 27. 4–5.
2.	Pyrenees. (*Verreaux.*)	Tomes Collection.	7. 1. 1. 15–16.
1.	Unknown.	F. Maxwell Lyte (p).	62. 1. 13. 2.
1 al.	Pyrenees.	(No history.)	
1.	Pyrenees.	Purchased (Parzudaki).	41. 918.
1.	Pyrenees.	Dr. J. E. Gray (p).	43. 10. 14. 1.
♂, ♀.	Pajáres, Leon, Spain. (*N. Gonzalez.*)	O. Thomas (p).	8. 2. 9. 47–48.

Galemys pyrenaicus rufulus Graells.

1897. *Myogalea rufula* Graells, Mem. Real. Acad. Sci., Madrid, xvii, p. 460.
1910. *Myogale pyrenaica rufula* Trouessart, Faune Mamm. d'Europe, p. 61.

Type locality.—Rio Balsain, above the Venta de los Mosquitos, Sierra de Guadarrama, Segovia, Spain.

Geographical distribution.—Central Spain, south of the Ebro Valley.

Diagnosis.—Hind foot, 36 to 38 mm.; condylobasal length

CRANIAL MEASUREMENTS OF *GALEMYS PYRENAICUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Breadth of brain-case.	Depth of brain-case (median).	Interorbital breadth.	Rostral breadth over canines.	Mandible.	Maxillary tooth-row (entire).	Mandibular tooth-row (entire).	Observations.
G. pyrenaicus pyrenaicus.												
France: no exact locality .	43.10.14.1		—	13·6	—	—	6·6	5·0	22·6	17·0	14·0	Teeth much worn.
,, ,, .	41.918		—	—	16·4	—	6·4	4·6	22·2	16·8	13·8	,, moderately worn.
,, ,, .	62.1.13.2	juv.	—	—	—	—	6·4	4·6	21·8	16·2	13·6	,, not worn.
Ax-les-Thermes, Ariège	1.7.27.1	♀	33·0	12·8	15·6	11·0	6·4	4·8	22·0	16·6	14·0	,, ,,
,, ,,	1.7.27.2	♀	33·4	13·0	16·0	11·0	6·4	4·8	22·0	16·8	13·8	,, moderately worn.
,, ,,	8.3.27.4	♂	33·6	13·2	16·2	11·6	6·6	4·6	22·4	17·0	14·0	,, ,,
,, ,,	8.3.27.5	♀	33·8	13·4	16·0	11·6	6·6	4·6	22·0	17·0	14·0	,, ,,
,, ,,	152522	♂	33·6	12·4	16·4	11·6	6·6	4·8	22·0	17·0	13·8	,, much worn.
Pyrenees . .	9099 Merriam		32·8	13·0	16·2	—	6·8	4·6	22·0	16·6	13·8	,, slightly worn.
Spain: Pajares, Leon . .	8.2.9.47	♀	—	—	—	—	—	4·2	22·0	17·0	13·6	,, ,,
G. pyrenaicus rufulus.												
Spain: Silos, Burgos . .	8.8.4.44	♂	34·8	13·4	17·0	11·0	6·0	4·6	23·0	18·0	14·2	,, ,,
,, ,, . .	8.8.4.43	♂	35·0	14·0	17·4	11·0	6·2	5·0	23·0	17·4	14·2	,, moderately worn.
,, ,, . .	172120	♂	35·4	13·8	17·4	11·2	6·4	5·0	24·0	18·0	14·4	,, slightly worn.
,, ,, . .	8.7.7.8	♀	34·8	13·8	17·0	12·0	6·8	4·6	22·4	17·2	14·0	,, ,,
,, ,, . .	8.7.7.9	♀	34·6	13·2	—	11·0	6·2	4·4	23·0	17·6	14·4	,, ,,

of skull about 34·5 to 35·5 mm. ; colour apparently not so dark as in the Pyrenean race.

Colour.—Upper parts essentially as in *G. pyrenaicus pyrenaicus*, but slightly less dark, the general hue somewhat leaden. Longer hairs on rump distinctly buffy. Pale area around eye larger and more noticeable than in the Pyrenean form.

Measurements.—Three males from Silos, Burgos, Spain : head and body, 123, 131 and 134 ; tail, 135, 145 and 156 ; hind foot, 36, 38 and 38. For cranial measurements see Table, p. 27.

Specimens examined.—Six, five from Silos, province of Burgos, Spain, and one from Buitrago, province of Madrid (U.S.N.M.).

Remarks.—The central Spanish form of *Galemys* appears to be well differentiated from true *pyrenaicus* by its greater size, a character which is particularly noticeable in the larger, more massive skull. Two specimens from the Asturias (Nos. 8. 2. 9. 47–48, Pajares, Leon, N. Gonzalez, collector) are apparently identical with the Pyrenean animal.

When in the water this animal shows much less agility than the water-rat and water-shrew, probably because, though in appearance the most perfectly adapted of the three to aquatic life, it retains too much of its Talpine inheritance of shortness of limb and heaviness of general form to be an active swimmer. Its defective vision, inherited from the same source, would also tend to a like result.

2 ♀ sks.	Silos, Burgos ; Spain.	Rev. S. Gonzalez (c).	8. 7. 7. 8–9.
♂, 2 sks.	Silos.	G. S. Miller (c).	8. 8. 4. 43–45.

Family SORICIDÆ.

1821. *Soricidæ* Gray, London Med. Repos., xv, p. 300, April 1, 1821.

Geographical distribution.—Throughout tropical and temperate Africa, Europe, Asia (including the Malay Archipelago), North America, and the extreme northern portion of South America.

Characters.—Skull long and narrow, strongly tapering anteriorly, most of the sutures disappearing early in life ; zygomatic arch incomplete, represented by a slight though usually evident rudiment of the zygomatic process of maxillary ; floor of braincase with median longitudinal bridge of bone and wide lateral fenestrate area on each side, in which auditory parts are suspended ; tympanic bone annular, not attached to skull ; basisphenoid without auditory process ; no external pterygoid plate ; mandible with complete double articulation ; anterior teeth not differentiated by form into incisors, canines and premolars, the first upper incisor very large, strongly projecting forward, its tip hooked downward, its base with a secondary lobe, the anterior lower incisor nearly straight, much produced in axis of mandible, the other anterior teeth forming a series of small "unicuspids," differing from each other chiefly in size ; crowns of upper molars

low, sub-quadrate in outline (except the much reduced third), the paracone and metacone near middle of crown, the styles and commissures well developed and forming an important functional part of the cutting apparatus; form mouse-like, but snout always pointed and much produced beyond incisors, eyes small, and ears often partly or entirely hidden in the fur.

Remarks.—The members of the family *Soricidæ* are at once recognizable among European Insectivora by their mouse-like form, small eyes, and sharply pointed muzzle. They are all of small size, the largest (*Neomys fodiens*) not so large as a house-mouse, while the smallest (*Pachyura etrusca*) is one of the least of known mammals. Notwithstanding their manifestly primitive general structure, the *Soricidæ* present a very high degree of specialization in the form of the anterior teeth, the absence of the zygoma, and the remarkable double articulation of the jaw. About fifteen genera are known. Four of these are represented in Europe.

KEY TO THE EUROPEAN GENERA OF *SORICIDÆ*.

Posterior lower molar with five cusps; teeth pigmented at tips; tail without sprinkling of elongated hairs.
Upper unicuspid teeth 5–5; cutting edge of anterior lower incisor with more than one lobe; feet not fringed ..... *Sorex*, p. 29.
Upper unicuspid teeth 4–4; cutting edge of anterior lower incisor with one lobe; feet fringed. (Water Shrews) ..... *Neomys*, p. 65.
Posterior lower molar with four cusps; teeth white throughout; tail with noticeable sprinkling of elongated hairs.
Upper unicuspid teeth 4–4 ..... *Pachyura*, p. 81.
Upper unicuspid teeth 3–3 ..... *Crocidura*, p. 86.

Genus **SOREX** Linnæus.

1758. *Sorex* Linnæus, Syst. Nat., I, 10th ed., p. 53.

1829. *Oxyrhin* Kaup, Entw.-Gesch. u. Natürl. Syst. Europ. Thierwelt, I, p. 119 (Included the undeterminable *Sorex constrictus* Hermann and *S. tetragonurus* Hermann; the latter may be chosen as type).

1835. *Amphisorex* Duvernoy, Mém. Soc. du Mus. d'Hist. Nat., Strasbourg, II, p. 23 (*hermanni* = *Neomys fodiens* skull + *Sorex araneus tetragonurus* animal) Part.

1838. *Corsira* Gray, Proc. Zool. Soc. London, 1837, p. 123. June 14, 1837 (*vulgaris* = *araneus*).

1842. *Otisorex* De Kay, Zool. of New York, I, Mamm., p. 22 (*platyrhinus* = *personatus*).

1857. *Sorex* Blasius, Säugethiere Deutschlands, p. 124.

1890. *Homalurus* Schulze, Schriften Naturwiss. Vereins Harzes in Wernigerode, V, p. 28 (*alpinus*).

Type species.—*Sorex araneus* Linnæus.

Geographical distribution.—Northern portion of both hemispheres; in Europe west to Ireland and south to central Spain and southern Italy.

Characters.—Upper unicuspid teeth 5–5 (dental formula: $i\ \frac{3-3}{1-1}$, $c\ \frac{1-1}{1-1}$, $pm\ \frac{3-3}{1-1}$, $m\ \frac{3-3}{3-3} = 32$): posterior lobe of anterior upper incisor fully half as high as main cusp; anterior lower incisor with three well developed lobes on cutting edge; third lower molar with hypoconid and entoconid small but distinct, so that the form of the tooth differs from that of first and second molars in the reduced size of the second triangle only, its crown, like the others, 5-cusped; second lower unicuspid with rudimentary second cusp and commissure; points of all the teeth pigmented (the coloured portion wearing away in extreme old age); skull lightly built, with slender weak rostrum and abruptly wider brain-case; rudimentary zygomatic process of maxillary evident; no special modifications in external form; tail covered with hairs of uniform length (except that those of pencil are elongated); ear nearly concealed by the fur, the meatus closed by a large valvular outgrowth from the antitragus supplemented by a fold on inner surface of conch; habits terrestrial.

Remarks.—This is the most widely distributed genus of Insectivora. It contains about sixty described forms, fourteen of which occur in Europe.

KEY TO THE EUROPEAN FORMS OF *SOREX*.

Anterior mandibular incisor with low, sometimes ill-defined lobes on cutting edge; first lower unicuspid two-pointed; lachrymal foramen over point of contact between m^1 and m^2; tail about as long as head and body; colour uniform dark slaty grey. (Alpine Shrews) ..... *S. alpinus*, p. 60.

Condylobasal length of skull 19·4 to 20·6 mm.; upper tooth-row 8·6 to 9·0 mm. (Alps; eastward to Transylvania) ..... *S. a. alpinus*, p. 62.

Condylobasal length of skull 19 to 19·6 mm.; upper tooth-row 8·2 to 8·6 mm. (Harz Mountains and Riesengebirge) ..... *S. a. hercynicus*, p. 63.

Anterior mandibular incisor with high, distinct lobes on cutting edge; first lower unicuspid single-pointed; lachrymal foramen in front of point of contact between m^1 and m^2; tail shorter than head and body; colour never uniform dark slaty grey, the under parts usually much lighter than back.

First, second and third upper unicuspids sub-equal; condylobasal length of skull 14·8 to 16·6 mm.; head and body usually about 50 to 60 mm. (Pigmy Shrews) ..... *S. minutus*, p. 53.

Molars and anterior upper incisor normal (Distribution general) ..... *S. m. minutus*, p. 55.

Molars and anterior upper incisor enlarged (Southern Italy) ..... *S. m. lucanius*, p. 60.

First and second upper unicuspid much larger than third; condylobasal length of skull 17·4 to 20 mm.; head and body usually about 65 to 80 mm. (Common Shrews) ..... *S. araneus*, p. 31.

Palate broad anteriorly, its width at level of first unicuspid nearly equal to that of tooth.
Condylobasal length of skull 18·4 to 19·2 mm.; anterior teeth enlarged (Island of Jersey)... *S. a. fretalis*, p. 45.
Condylobasal length of skull about 17·5 mm.; anterior teeth not enlarged (Mountains of central Spain) ..... *S. a. granarius*, p. 52.
Palate narrow anteriorly, its width at level of first unicuspid barely more than half that of tooth.
Condylobasal length of skull usually 19 to 20 mm.; hind foot usually 13 to 14·4 mm. (mountain and northern forms).
Hind foot 13·6 to 14·4 mm.; colour in summer pelage very dark, the tricolor pattern usually conspicuous (South-western Norway) ..... *S. a. bergensis*, p. 41.
Hind foot 13·0 to 14 mm.; colour in summer pelage frequently light and brownish.
Back frequently blackish in summer pelage (Alps and neighbouring regions)..... *S. a. tetragonurus*, p. 42.
Back rarely if ever blackish in summer pelage (Pyrenees)..... *S. a. pyrenaicus*, p. 44.
Condylobasal length of skull usually 17·4 to 19 mm.; hind foot usually 11 to 13 mm. (lowland forms).
Underparts blackish, not contrasted with back (Charente, France)..... *S. a. santonus*, p. 40.
Underparts greyish or brownish, contrasted with back except when latter is also brown.
Colour of sides not distinctly contrasted with that of back; belly heavily washed with wood-brown (Plains of south-western France)..... *S. a. euronotus*, p. 41.
Colour of sides usually forming distinct contrast with that of back; belly lightly washed with wood-brown.
Average colour darker, the back ranging from bister to a deep blackish brown (Central Europe and Scandinavia, except south-western Norway) ..... *S. a. araneus*, p. 35.
Average colour less dark, the back ranging from hair-brown tinged with bister to seal-brown (Great Britain) ..... *S. a. castaneus*, p. 37.

SOREX ARANEUS Linnæus.

(Synonymy under subspecies.)

Geographical distribution.—Northern portions of Europe and Asia from England and Scotland eastward; exact limits of range unknown; in western Europe south to central Spain, and central Italy, north to northern Scandinavia.

Diagnosis.—Size medium, head and body usually about 65–80 mm, the tail 20–35 mm. shorter, condylobasal length of skull, 17·8–20 mm.; posterior lobe of anterior upper incisor

compressed laterally, the length of its base equal to that of base of anterior cusp; colour brown or blackish, the underparts never as dark as back (usually much lighter), and the sides often contrasted with both.

External characters.—Fur moderately dense, its depth at middle of back about 4 mm. in summer, 8 mm. in winter, its texture not specially modified; no elongated hairs on flanks and across rump. Eyes small and inconspicuous; ears nearly concealed in the fur. Feet not peculiar in form, thinly clothed with very fine hairs on dorsal surface: fore foot with third and fourth digits sub-equal and longest, fifth extending just beyond base of fourth, first barely reaching base of second, the claws small but well developed; palm so conspicuously rugose reticulate that tubercles are not very distinct; tubercles 6, sub-equal, the three at bases of main digits well-defined, that at base of thumb sometimes confluent with that at inner side of wrist (so that the number is apparently reduced to 5), the two wrist-pads separated from each other in median line by a noticeable space: extreme posterior edge of palm covered with ordinary integument. Hind foot with third and fourth digits sub-equal and longest, second slightly shorter, fifth reaching base of fourth, and first extending to base of fifth; surface of sole as in palm, but tubercles better defined, four at bases of digits and two situated more posteriorly, all six about equal in size; sole finely haired from hinder tubercles to heel, the middle of which is bare; claws like those of fore-foot. Tail terete or somewhat 4-sided, rather more than half as long as head and body, its hairs minute, rather closely appressed, and nearly concealing the annulation; pencil usually well developed, 4–6 mm. in length, but occasionally in aged individuals much reduced or absent, together with the rest of the hairy covering of the tail. Caudal annulations rather indistinct, about 24 to the centimeter at middle. Mammæ: $2\ 3-3=6$.

Colour.—Dorsal area, extending from base of tail to crown cheeks and muzzle, brown, the exact shade varying much both seasonally, racially and individually, but the normal extremes falling between hair-brown or light bister and a very dark, blackish seal-brown. Sides wood-brown, usually forming an evident contrast with dorsal area, though this contrast is occasionally inconspicuous in dull light specimens in summer coat, or wholly obliterated in the general darkening of entire animal in *S. araneus santonus*. Underparts smoky grey washed with wood-brown, or occasionally suffused with slaty (particularly in the dark *S. a. santonus*). Between colour of back and sides there is usually an evident line of demarcation; between sides and belly the contrast is less marked and the transition less abrupt. Feet a dull indefinite light brown, often with a faint dark shade along outer edge. Tail dark brown above and at tip, light brown below, especially near base, sometimes bicolor throughout.

While there is no invariable rule, the colour in winter is usually darker than in summer, and the tricolor pattern of dark back, yellowish brown sides and greyish belly is more pronounced. A trace of this pattern is often the most convenient character by which to recognize shrunken ill-prepared specimens, which might otherwise be mistaken for *Sorex minutus*.

Skull.—The skull is slender and lightly built, with no special peculiarities of form as compared with that of other shrews. Brain-case well marked off from interorbital region, its surface smooth except in extreme old age, its main sutures remaining open until late in life. It is sub-circular in general outline when viewed from above, but with antero-external portion of border noticeably flattened, so that at point of greatest breadth there is usually an evident angle; condyles scarcely visible, causing no break in posterior outline. Depth of brain-case at middle slightly more than half greatest width; no sagittal crest except in extreme old age; lambdoid crest at first confined to lateral portions of occiput, rarely extending to median line. Dorsal profile usually with evident concavity in interorbital region (more marked than in *Sorex minutus* and *S. alpinus*). Nares broadly rounded posteriorly, the lateral margin obtusely angled near middle. Anteorbital foramen moderately large, not very conspicuous when skull is viewed from in front. Lachrymal foramen over middle of m^1. Mesopterygoid space nearly parallel-sided, less than half as wide as long.

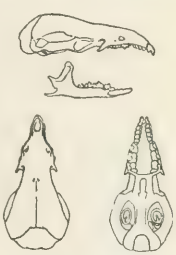

FIG. 7.
Sorex araneus.
Nat. size.

Teeth.—Anterior upper incisor with basal lobe relatively larger than in any other European shrew, the length of its base nearly equal to diameter of anterior lobe at level of angle between the two cusps. When tooth is viewed from below the posterior lobe appears nearly as large as anterior cusp; in lateral view it approximates the size and form of first and second unicuspid, and in height falls a little short of anterior cusp. The two teeth come in contact anteriorly slightly below tips, which do not diverge conspicuously. Anterior lower incisor robust, its shaft very slightly tapering, its cutting edge with three well-developed lobes, the lengths of bases of which diminish regularly from first to third, the first lobe more distinctly separated from succeeding lobe than from anterior point of tooth. Upper unicuspids robust, their crowns squarish in outline when viewed from below, bluntly triangular when viewed from the side; height about equal to length: anterior and posterior borders straight or faintly concave, upper border convex, more strongly posteriorly than anteriorly. The highest point of cusp lies slightly in front of middle of crown. Upper

and posterior borders sub-equal, slightly longer than anterior border. Cusp rounded on antero-external face, squarely truncate postero-internally along line connecting antero-internal and postero-external corners of crown. The region behind this line is occupied by a flattened or somewhat concave, nearly horizontal crushing surface opposed during mastication to second and third lobes of lower incisor (1st and 2nd upper unicuspids) and to points of the two lower unicuspids (3rd and 4th upper unicuspids). In size the first and second unicuspids are sub-equal and decidedly larger than third, which in turn somewhat exceeds fourth. Fifth still smaller than fourth and closely crowded between it and antero-external cusp of large premolar, its cusp relatively lower than in the other teeth of the series. First lower unicuspid essentially similar to first and second upper, but crown longer than broad and without distinct crushing surface. Second larger than first, not conspicuously different from it in general form when viewed from the side, but cutting edge much longer and better developed, distinctly angled behind middle, the angle clearly representing a rudimentary second cusp, and transverse portion behind it a second commissure, the tooth thus containing the modified elements of one of the triangles of a molar. Large upper premolar with protocone smaller than in the first and second molars, though well developed and of essentially the same form; paracone smaller than protocone, therefore much smaller than in first and second molars; hypocone small but well developed; posterior margin of crown more deeply emarginate than that of molars. Crowns of first and second molars squarish in outline, though somewhat wider posteriorly than anteriorly. Outer re-entrant angles deeper in second than in first. Protocone long and rather

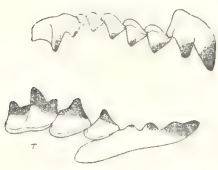

FIG. 8.

Sorex araneus. Anterior teeth in profile. × 5.

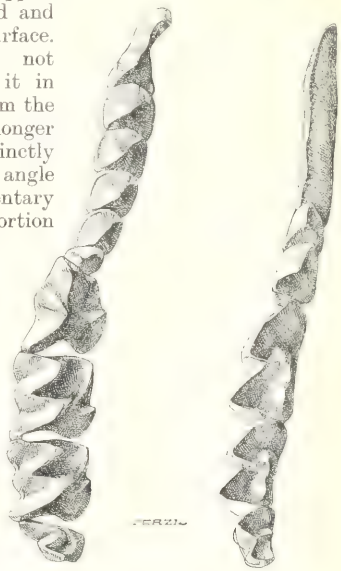

FIG. 9.

Sorex araneus. Teeth × 10.

low. Hypocone small but well developed. Third upper molar with about half the crown area of second, all the elements of the tooth present except hypocone. First and second lower molars alike in size and form, the posterior triangle slightly larger than anterior. Third molar smaller than the others, the relative size of the triangles reversed, but elements of tooth all present.

Measurements.—While there is some variation in size among the different races the head and body in full-grown individuals is seldom if ever less than 65 or more than 80 mm. The tail falls short of head and body by from 20 to 35 mm., being thus relatively shorter than in either of the other European species. The hind foot ranges from 11 to about 14·5 mm. and the condylobasal length of skull from 17·8 to 20 mm. Detailed measurements are given under each of the subspecies.

Remarks.—*Sorex araneus*, the most widely distributed and best known of the European shrews, is so easily recognized that it needs no special comparison with the other species. Specimens of the dark race from Charente, France, have a superficial likeness to *Sorex alpinus*, but are at once distinguishable externally by their blackish instead of slaty coloration and relatively short tail. Immature, dull coloured individuals of the other races may occasionally be confused with *S. minutus*. The same is true of shrunken, badly prepared skins. But some trace of the tricolor pattern can almost invariably be found in a common shrew no matter what its condition, while a glance at the size of the teeth and form and proportions of the unicuspids will always serve to determine the identity of any specimen in hand.

Sorex araneus araneus Linnæus.

1758. [*Sorex*] *araneus* Linnæus, Syst. Nat., I, 10th ed., p. 53 (Sweden).
1828. *Sorex coronatus* Millet, Faune de Maine-et-Loire, I, p. 18 (Blou, Maine-et-Loire, France).
1828. *Sorex personatus* Millet, Faune de Maine-et-Loire, I, p. 18, footnote (Rejected MS. name for *coronatus*). Not *Sorex personatus* I. Geoffroy, 1827.
1832. *Sorex concinnus* Wagler, Isis, p. 54 (Bavaria).
1832. *Sorex rhinolophus* Wagler, Isis, p. 54 (Bavaria).
1832. *Sorex melanodon* Wagler, Isis, p. 54 (Bavaria).
1838. *Sorex vulgaris* Nathusius, Wiegmann's Archiv für Naturgesch. IV, I, p. 45.
1839. S[*orex*] *macrotrichus* de Sélys-Longchamps, Études de Micromamm., p. 20. (Specimen of *S. araneus* briefly described as agreeing with the *S. macrotrichus* Mehlis MSS. No locality given.)
1839. S[*orex*] *labiosus* Jenyns, Ann. Nat. Hist., II, p. 326, January, 1839. (Frankfurt a/M., Germany.)
1857. *Sorex vulgaris* Blasius, Säugethiere Deutschlands, p. 129 (part).
1895. *Sorex araneus* Thomas, The Zoologist, 3rd ser., XIX, p. 63, February, 1895.
1910. *Sorex araneus* Trouessart, Faune Mamm. d'Europe, p. 51 (part).

Type locality.—Upsala, Sweden.

Geographical distribution.—Western Continental Europe,

except Atlantic watershed of south-western Norway, from Finland to central France, central Germany, and northern Hungary. Exact southern and eastern limits of range not known.

Diagnosis.—Size small (condylobasal length of skull usually 17·8 to 19 mm., hind foot usually 11 to 13 mm.); colour rather dark, the back ranging from bister to a deep blackish brown; sides distinctly lighter than back except in specimens representing the pallid extreme of colouration; teeth moderately pigmented, the hypocone of m^1 and m^2 usually white to tip.

Teeth.—The teeth show no special peculiarities of form. In pigmentation they represent the extreme of restriction of the dark areas. While the area of pigmentation on all of the cusps is less extensive than in the Alpine and Pyrenean races, the differences are best seen in the hypocones of the three large upper cheek teeth and protocone of m^3, as these small cusps, unlike the larger ones, may be completely without brown colour. A comparison of seventy-five topotypes of *Sorex araneus* with eighty Swiss specimens of *S. araneus tetragonurus* gives the following results:—

	araneus.	*tetragonurus.*
Large premolar with pigment on hypocone	·0 %	38·7 %
First molar with pigment on hypocone	22·6 %	93·7 %
Second molar with pigment on hypocone	21·2 %	88·7 %
Third molar with pigment on protocone	45·3 %	100·0 %
None of the small cusps pigmented	54·6 %	·0 %
All of the small cusps pigmented	·0 %	37·2 %

Measurements.—Average and extremes of twenty specimens from the type locality: head and body, 77·5 (72–85); tail, 40·1 (38–43); hind foot, 12·6 (12–13). Average and extremes of nine specimens from Lillehammer, central Gudbrandsdal, Norway (dry): hind foot, 12·3 (12·2–12·6). Average and extremes of four specimens from Holaaker, upper Gudbrandsdal, Norway: head and body, 70·2 (69–71); tail, 36·5 (34–39); hind foot, 12·2 (12–13). Average and extremes of twenty specimens from Brunswick, Germany: head and body, 78·9 (68–85); tail, 39·7 (36–45); hind foot, 12·7 (12·2–13·0). Average and extremes of ten specimens from Waremme, Liége, Belgium: head and body, 68·9 (66–72); tail, 42·3 (38–47); hind foot (dry), 12·2 (11·8–12·8). For cranial measurements see Table, p. 46.

Specimens examined.—Two hundred and ninety-eight, from the following localities:—

Norway: Mölmen, Upper Gudbrandsdal, 2; Holaaker, Upper Gudbrandsdal, 4; Lesjevark, Middle Gudbrandsdal, 1; Lillehammer, Middle Gudbrandsdal, 9 (U.S.N.M.); Eggedal, Buskerud, 8 (U.S.N.M.); Spjosod, Telemarken, 4 (U.S.N.M.); Asker, near Christiania, 4 (U.S.N.M.); Holme, Mandal, 7.

Sweden: Upland, 1; Upsala, 97 (U.S.N.M.); Skaane, 3 (U.S.N.M.).

Denmark: Hilleröd, Zealand, 6; Nystad, Lolland, 3 (U.S.N.M.); Skansen, Lolland, 1 (U.S.N.M.).

Holland: Oosterbeek, Guelderland, 6; Leiden, 4 (U.S.N.M.).

Belgium: Hastière, Namur, 1; Waremme, Liége, 10 (U.S.N.M.).

France: Guines, Pas-de-Calais, 4; Manonville, Meurthe-et-Moselle, 2; Barbizon, Seine-et-Marne, 3.

GERMANY: Brunswick, 35 (B.M. and U.S.N.M.); Bodethal, Harz Mts., 15 (U.S.N.M.); Mauseklippe, Harz Mts., 2 (U.S.N.M.); Bahrenberg, Harz Mts., 9 (U.S.N.M.); Tharand, Saxony, 1; Magdeburg, Saxony, 5; Moritzburg, Saxony, 1 (U.S.N.M.); Ingelheim, Rheinhessen, 3; Nuremberg, Bavaria, 10 (U.S.N.M.); Marxheim, near Monheim, Bavaria, 15; Strass, near Burgheim, Bavaria, 1; Eulengrund, Riesengebirge, Silesia, 2 (U.S.N.M.); Wolfshau, near Sneekoppe, Riesengebirge, Silesia, 8 (U.S.N.M.); Niesky, Silesia, 5; near Königsberg, 6 (U.S.N.M.); no exact locality, 1.

AUSTRIA-HUNGARY: Haida, Arva, Bohemia, 9.

♂, ♀.	Mölmen, Gudbrandsdal. Norway.	R. J. Cuninghame (P).	98. 5. 2. 1–2.
2 ♂, 2 ♀.	Holaaker, Gudbrandsdal, 1900 ft.	R. J. Cuninghame (P).	98. 2. 28. 1–4.
♂.	Lesjevark, Gudbrandsdal.	Miller Collection.	7. 7. 7. 4452.
♂, 5 ♀.	Holme, Mandal, 200 ft.	R. J. Cuninghame	8. 8. 9. 1–6.
♂ al.	Norway.	(P).	8. 8. 9. 40.
♀.	Upland, Sweden. (*G. Kolthoff.*)	Lord Lilford (P).	8. 9. 8. 19.
4 ♂, 2 ♀.	Hilleröd, Zealand, 10 m. Denmark.	O. Thomas (C & P).	98. 6. 7. 2–7.
4 ♂, 2 ♀.	Oosterbeek, Guelderland, 10–15 m. Holland.	O. Thomas (C & P).	98. 2. 1. 6–8.
♀.	Hastière, Namur, Belgium.	G. A. Boulenger (C & P).	94. 7. 9. 1.
3 ♂, 1 ♀.	Guines, Pas-de-Calais, 10 m. France.	O. Thomas (C & P).	94. 6. 6. 4–7.
2 ♂, 2 ♀.	Barbizon, Seine-et-Marne.	G. S. Miller (C).	8. 8. 4. 155–158.
♂, 3 ♀, 2.	Auerum Forest, Brunswick, Germany.	G. Barrett-Hamilton (C & P).	11. 1. 2. 75–80.
♀.	Tharandt, Saxony.	Lord Lilford (P).	99. 1. 9. 14.
5 al.	Magdeburg, Saxony.	Dr. W. Wolterstorff (P).	92. 12. 1. 3–7.
♂, 2 ♀.	Ingelheim, Rheinhessen.	C. Hilgert (C).	8. 11. 2. 6–8.
3 ♂, 4 ♀.	Marxheim, Bavaria.	Lord Lilford (P).	8. 9. 8. 7–13.
2 ♂.	Bayreuth, Bavaria.	Miller Collection.	7. 7. 7. 2868–2869.
♂.	Strass, Burgheim, Bavaria.	Lord Lilford (P).	8. 9. 8. 20.
3 ♂, 2 ♀.	Niesky, Silesia, 200 m. (*W. Baer.*)	Lord Lilford (P).	99. 1. 9. 9–13.
2 al.	No exact locality.	Zool. Soc. Collection.	55. 12. 26. 300–301.
1.	Germany.	Stockholm Museum (E).	46. 6. 2. 36.
3 ♂, 4 ♀.	Haida, Bohemia.	Lord Lilford (P).	8. 9. 8. 14–18.
2.	Haida, Bohemia.	Lord Lilford (P).	8. 9. 8. 21–22.

SOREX ARANEUS CASTANEUS Jenyns.

1838. *S[orex] tetragonurus* var. β *S[orex] castaneus* Jenyns, Ann. Nat. Hist., I, p. 424, August, 1838 (Burwell Fen, Cambridgeshire, England).

1857. *Sorex vulgaris* Blasius, Säugethiere Deutschlands, p. 129 (part)

1910. *Sorex araneus* Trouessart, Faune Mamm. d'Europe, p. 51 (part).

Type locality.—Burwell Fen, Cambridgeshire, England.

Geographical distribution.—Great Britain. Usually confined

to the mainland, though occurring on Bardsey Island, Carnarvonshire.

Diagnosis.—Similar to *Sorex araneus araneus*, but colour in series of skins averaging less dark, that of dorsal area ranging from hair-brown slightly tinged with bister to seal-brown, and seldom if ever attaining the deep blackish brown frequently seen in the typical race.

Skull and teeth.—The skull and teeth resemble those of true *Sorex araneus*.

Measurements.—Average and extremes of ten specimens from Cromarty, Scotland: head and body, 70·6 (62–78); tail, 39·8 (38–43); hind foot, 12·9 (12·5–13). Average and extremes of eight specimens from Aberia, Merioneth: head and body, 67·5 (58–73); tail, 38·7 (36–41); hind foot, 12 (11–13). Average and extremes of eight specimens from Grimsby, Lincolnshire: head and body, 65·2 (58–72); tail, 42 (38–44); hind foot, 12·5 (12–13). Average and extremes of six specimens from Northlew, Devonshire: head and body, 66·6 (65–70); tail, 36·8 (35–39); hind foot, 13 (13). For cranial measurements see Table, p. 48.

Specimens examined.—Two hundred and fifty-two, from the following localities:—

Scotland: Black Isle, Cromarty, 16; South Sutor, Cromarty, 5; Nairn, Morayshire, 4; Dunphail, Elgin, 2; Gordonstown, Elgin, 3; Lhanbride, Elgin, 1; Lossiemouth, Elgin, 3; Grantown-on-Spey, Elgin, 26 (Wilson); Kennordy, 1 (Wilson); Cortachy, Forfar, 6 (Wilson); Cromlix, Stirling, 10; Islay, 3; Dunkeld, Perthshire, 2; Loch Earn Head, Perthshire, 1; Stockbriggs, Lanarkshire, 2; Kirtle Bridge, Dumfriesshire, 4; Wyseby, Dumfriesshire, 3.

Wales: Aberia, Merionethshire, 8; near Bridgend, Glamorganshire, 6 Bardsey Island, Carnarvonshire, 1.

England: Berwick-on-Tweed, Northumberland, 2; Riding Mill-on-Tyne, Northumberland, 3; Newby Bridge, Lake Windermere, Cumberland, 1; Grimsby, Lincolnshire, 17; Whitnash, Warwickshire, 1; Rugby, Warwickshire, 2; Filey, Yorkshire, 3; Wellersey Hill, Broadway, Worcestershire, 1; West Cheshire, 1; Shropshire, 1; Staffordshire, 1; Swithland, Leicestershire, 10; Bishopstoke, Herefordshire, 1; Leominster, Herefordshire, 1; Graftonbury, Herefordshire, 19; Lilford, Northamptonshire, 2; Drinkstone Park, Bury St. Edmunds, Suffolk, 2; Lowestoft, Suffolk, 6; Wormsley, Oxfordshire, 1; Stokenchurch, Oxfordshire, 4; Cambridgeshire, 1; Kensington Gardens, London, 1; Hillingdon, Middlesex, 3; Bletchingley, Surrey, 4; Godalming, Surrey, 2; Merstham, Surrey, 1; Richmond Park, Surrey, 1; Crowborough, Sussex, 3; St. Leonard's, Sussex, 1; Tunbridge Wells, Sussex, 1; Eastwell, Kent, 3; Lyndhurst Road, Hampshire, 2; New Forest, Hampshire, 17; Basingstoke, Hampshire, 1; Alum Bay, Isle of Wight, 3; Clifton Bridge, Gloucestershire, 2; Leigh Woods, Clifton, Gloucestershire, 3; Blandford, Dorsetshire, 1; Combmartin, Devonshire, 4; Chagford, Devonshire, 5; Northlew, Devonshire, 6; no exact locality, 3.

Remarks.—While the British common shrew is an incompletely differentiated form, the average characters of the large series of specimens examined seem important enough to warrant the use of Jenyn's name. As compared with the Continental

race the dark extreme is less dark and less frequent, while the light extreme is more light and more frequent. The constantly small size of this animal as compared with the large Continental races (*bergensis*, *tetragonurus* and *pyrenaicus*), is shown by the fact that among 102 British specimens measured by many different collectors the hind foot exceeds 13·2 mm. in only six instances.

♀.	Black Isle, Cromarty, Scotland.	W. R. Ogilvie-Grant (C & P).	94. 10. 6. 1.
9 ♂.	Black Isle, Cromarty.	W. R. Ogilvie-Grant (C & P).	11. 1. 3. 103–107. 109–112.
2 ♂.	South Sutor, Cromarty.	W. R. Ogilvie-Grant (C & P).	11. 1. 3. 108, 113.
2 ♂, 2 ♀.	Nairn, Morayshire.	W. R. Ogilvie-Grant (C & P).	11. 1. 3. 99–102.
♂.	Morayshire.	E. R. Alston (C & P).	79. 9. 25. 79.
♀.	Dunphail, Elginshire.	W. R. Ogilvie-Grant (C & P).	11. 1. 3. 97.
1.	Lhanbride, Elginshire.	Miller Collection.	7. 7. 7. 3598.
2 ♂.	Gordonstown, Elginshire.	W. R. Ogilvie-Grant (C & P).	11. 1. 3. 95–96.
♂.	Gordonstown, Elginshire.	W. R. Ogilvie-Grant (C & P).	11. 1. 3. 98.
3 ♂, 7 ♀.	Cromlix, Stirlingshire.	W. R. Ogilvie-Grant (C & P).	11. 1. 3. 114–123.
3 al.	Islay.	H. Russell (C & P).	9. 9. 11. 1–3.
♂, ♀.	Stockbriggs, Lanarkshire.	E. R. Alston (C & P).	79. 9. 25. 11–12.
♂, 3 ♀.	Kirtle Bridge, Dumfriesshire.	Miss D. Bate (C & P).	11. 1. 3. 88. 11. 1. 3. 92–94.
3 ♀.	Wyseby, Dumfriesshire.	Miss D. Bate (C & P).	11. 1. 3. 89–91.
5 ♂, 3 ♀.	Aberia, Merionethshire, Wales.	G. H. Caton Haigh (C & P).	11. 1. 3. 156–163.
3 ♂, 3 ♀.	Bridgend, Glamorganshire.	R. I. Pocock (C & P).	11. 1. 3. 164–169.
2 al.	Berwick-on-Tweed, Northumberland, England.	J. H. Fryer (C & P).	47. 11. 11. 6–7.
1 al.	Newby Bridge, Cumberland.	J. Paul (C & P).	94. 9. 3. 2–3.
♂, 5 ♀, 2.	Grimsby, Lincolnshire.	G. H. Caton Haigh (C & P).	11. 1. 3. 124–131.
♂, 6 ♀.	Swithland, Leicestershire.	F. A. Butler (C & P).	11. 1. 3. 132–138.
1 al.	Shropshire.	T. C. Eyton (C & P).	63. 10. 12. 4.
♀ al.	Bishopstoke, Herefordshire.	S. O. Ridley (C & P).	84. 10. 6. 1.
8 ♂, 8 ♀.	Graftonbury, Herefordshire.	W. de Winton (C & P).	11. 1. 3. 72–87.
3 st.	Graftonbury, Herefordshire.	W. de Winton (C & P).	96. 4. 28. 17–19.
2 al.	Bury St. Edmunds, Suffolk.	J. H. Powell (C & P).	80. 5. 22. 1–2.
3 ♂, 3 ♀.	Lowestoft, Suffolk.	O. Thomas (C & P).	11. 1. 3. 139–144.
4 ♀.	Stokenchurch, Oxfordshire.	W. R. Ogilvie-Grant (C & P).	11. 1. 3. 145–148.
3 ♀.	Hillingdon, Middlesex. (*O. Thomas.*)	Miller Collection.	7. 7. 7. 3595–3597.

1.	Kensington Gardens, London.	N. Churton (c & p).	161. a.
4 ♀.	Bletchingley, Surrey.	W. R. Ogilvie-Grant (p).	11. 1. 3. 149–152.
1.	Crowborough, Sussex. (*W. R. Ogilvie-Grant.*)	Miller Collection.	7. 7. 7. 3593.
♀ al.	Richmond Park, Surrey.	Prof. Owen (p).	75. 9. 17. 1.
7 ♂, 10 ♀.	New Forest, Hampshire.	Miller Collection.	7. 7. 7. 2851–2867. 3023.
♀.	Basingstoke, Hampshire. (*W. P. Stark.*)	Miller Collection.	7. 7. 7. 3611.
♂, 2 ♀.	Alum Bay, Isle of Wight.	O. Thomas (c & p).	11. 1. 8. 153-155.
♀ (albino)	Winscombe, Somerset.	F. A. Knight (c. & p).	4. 8. 9. 1.
♂, 4 ♀.	Northlew, Devonshire.	R. C. Wroughton (c & p).	11. 1. 3. 170–174.
2 ♂, 3 ♀.	Chagford, Devonshire. (*W. P. Stark.*)	Miller Collection.	7. 7. 7. 3606–3610.
1 al.	England.	Dr. J. E. Gray (p).	46. 5. 2. 7.

Sorex araneus santonus Mottaz.

1908. *Sorex santonus* Mottaz, Bull. Soc. Zool. de Genève, I, p. 118, April 30, 1908. Type in Mottaz Collection.
1910. *Sorex santonus* Trouessart, Faune Mamm. d'Europe, p. 54.

Type locality.—Lignières-Sonneville, Charente, France.

Geographical distribution.—Known only from the vicinity of the type locality.

Diagnosis.—Size as in *Sorex araneus araneus* and the other small races; colour throughout a nearly uniform dark sooty brown.

Colour.—Upper parts dark sepia anteriorly, deepening to blackish posteriorly, the sides essentially similar to the back. Underparts a slaty drab washed with wood-brown and forming no evident contrast with sides and back, though a well-defined line of demarcation is present. Tail blackish throughout. Feet scantily clothed with inconspicuous brownish hairs.

Skull and teeth.—The skull and teeth do not differ appreciably from those of the other small races.

Measurements.—Type (female), from Mottaz: head and body, 75; tail, 42; hind foot, 13. For cranial measurements see Table, p. 51.

Specimens examined.—Ten, all from the type locality (Mottaz).

Remarks.—The Charente shrew is so different in aspect from the other European races of *Sorex araneus* that it needs no special comparison with any of them. Its peculiar colour is, however, almost exactly duplicated by that of a larger, longer-tailed form from Asia Minor.

Sorex araneus euronotus Miller.

1901. *Sorex araneus euronotus* Miller, Proc. Biol. Soc., Washington, XIV, p. 44, April 25, 1901 (Montréjeau, Haute-Garonne, France). Type in U.S. National Museum.

1910. *Sorex araneus euronotus* Trouessart, Faune Mamm. d'Europe, p. 53.

Type locality.—Montréjeau, Haute-Garonne, France.

Geographical distribution.—Probably the plains between the Pyrenees and the Garonne. At present known from the type locality only.

Diagnosis.—Similar to *Sorex araneus araneus*, but colour in summer (winter pelage not known) more dull, the sides scarcely if at all contrasted with the back, and underparts more heavily washed with wood-brown. Skull with slightly narrower less elevated brain-case, and teeth just perceptibly smaller than in true *araneus*.

Measurements. External measurements of type specimen: head and body, 78; tail, 44; hind foot (dry), 12·6. Average and extremes of nine specimens from the type locality: head and body, 71·4 (67–78); tail, 42 (37–44); hind foot (dry), 12·5 (12·2–13·0). For cranial measurements see Table, p. 51.

Specimens examined.—Nine, all from the type locality (U.S.N.M.).

Sorex araneus bergensis Miller.

1909. *Sorex araneus bergensis* Miller, Ann. and Mag. Nat. Hist., 8th ser., III, p. 416, May, 1909. Type in U.S. National Museum.

1910. *Sorex araneus bergensis* Trouessart, Faune Mamm. d'Europe, p. 52.

Type locality.—Graven, Hardanger, Norway.

Geographical distribution.—Western Norway, from region of Bergen, north at least into Nordland.

Diagnosis.—Larger than *Sorex araneus araneus* (hind foot, 13·6 to 14·4 mm.; condylobasal length of skull, 19 to 20 mm.), and colour in summer pelage darker, the dark brown or blackish dorsal area sharply defined from the yellowish brown of sides.

Colour.—Dorsal area well defined, ranging from a blackish seal-brown to bister, usually darker on rump and lumbar region than on head, and almost invariably with sharp lateral line of demarcation. Sides yellowish isabella-colour. Underparts greyish, washed with light wood-brown. The contrast between colour of sides and underparts, though less marked than that between sides and back, is usually evident. Feet scantily clothed with inconspicuous isabella-coloured or dusky hairs. Tail obscurely bicolor, brownish above, dull yellowish below.

Skull and teeth. The skull and teeth do not differ appreciably from those of *Sorex araneus araneus*, except in their larger size, as shown by the detailed measurements. The pigmentation of

the teeth is scarcely, if at all, more extensive than in the typical race.

Measurements.—External measurements of type: head and body, 80·5; tail, 44·5; hind foot, 13·6. Average and extremes of eleven specimens from the Bergen district: head and body, 78·7 (76–83); tail, 49·3 (44–56); hind foot, 13·8 (13·6–14·4). For cranial measurements see Table, p. 51.

Specimens examined.—Twenty-seven, from the following localities:—NORWAY: Vefsen, Nordland, 1; Skjærdal, Nordfjord, 7; Opheim, Bergen, 4; Graven, Bergen, 8 (U.S.N.M.); near city of Bergen, 7 (B.M. and U.S.N.M.).

Remarks.—This large race of *Sorex araneus*, closely resembling the large Alpine and Pyrenean forms, but decidedly darker in colour, appears to be strictly confined to the Atlantic slope of western Norway. On the eastern watershed it is replaced by true *araneus*, even so far north and west as the upper portion of the Gudbrandsdal. I have not seen specimens in full winter pelage, but an adult female taken at Graven on June 10, 1898 (No. 84,663, U.S.N.M.), is moulting, the winter fur remaining on posterior half of body. Others taken at the same place and about the same date have completed the change to the short, velvety summer coat.

1.	Vefsen, Nordland, Norway.	E. G. B. Meade Waldo (C & P).	5. 7. 1. 2.
♂, 4 ♀.	Skjærdal, Nordfjord.	C. H. Stephenson (C & P).	8. 1. 5. 1–5.
2 ♂, 2 ♀.	Opheim, Bergen.	Miller Collection.	7. 7. 7. 4453–4456.
♂, 2 ♀.	Bergen.	Miller Collection.	7. 7. 7. 4457–9.
♀.	Bergen, 2,700 ft.	G. Barrett-Hamilton (P).	8. 9. 21. 1.

SOREX ARANEUS TETRAGONURUS Hermann.

1780. *Sorex tetragonurus* Hermann in Zimmermann, Geogr. Gesch., II, p. 383 (Strassburg, Germany).

1792. *Sorex quadricaudatus* Kerr, Anim. Kingd., p. 208 (Strassburg, Germany). (Based on Pennant's account of *S. tetragonurus* Hermann.)

1835. *Sorex fodiens* Duvernoy, Mém. Soc. du Mus. d'Hist. Nat., Strasbourg, II, p. 17. Part: skull, *not* animal.

1835. *Sorex hermanni* Duvernoy, Mém. Soc. du Mus. d'Hist. Nat., Strasbourg, II, p. 23 (Near Strassburg, Germany). Part: animal, *not* skull.

1857. *Sorex vulgaris* Blasius, Säugethiere Deutschlands, p. 129 (part).

1868. ? *Sorex araneus, pallidus* Fitzinger, Sitzungsber. kais. Akad. Wissensch., Wien, Math. Naturwiss. Classe, LVII, pt. I, p. 488 (Based on specimen from unknown locality, probably in Italy, figured by Bonaparte, Iconogr. Faun. Ital., fasc. XXIX, pl., fig. 5.)

1869. [*Sorex vulgaris*] var. *nuda* Fatio, Faune Vert. Suisse, I, p. 127 (Bernese Oberland, Switzerland).

1869. [*Sorex vulgaris*] var. *nigra* Fatio, Faune Vert. Suisse, I, p. 127 (Lucerne, Switzerland).

1900. *S[orex] vulgaris* var. vel subsp. *mollis* Fatio, Rev. Suisse de Zool., VIII, p. 471 (Substitute for *nigra*).

1901. *Sorex araneus alticola* Miller, Proc. Biol. Soc., Washington, XIV, p. 43, April 25, 1901 (Meiringen, Switzerland). Type in U.S. National Museum.

1905. *S[orex] vulgaris crassicaudatus* Fatio, Arch. Sci. Phys. et Nat., Genève, 4th ser., XIX, p. 201, February 15, 1905 (Zermatt, Switzerland). Cotypes in Geneva Museum.

1905. *Crossopus* ou *Sorex ignotus* Fatio, Arch. Sci. Phys. et Nat., Genève, 4th ser., XIX, p. 202, February 15, 1905 (Switzerland). Part: mandible, *not* skull. Type in Geneva Museum.

1905. *Sorex araneus carpathicus* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., XV, p. 506, May, 1905 (Hatszeg, Hunyad, Hungary). Type in British Museum.

1910. *Sorex araneus tetragonurus* and *S. araneus carpathicus* Trouessart, Faune Mamm. d'Europe, pp. 52, 54.

Type locality.—Strassburg, Germany.

Geographical distribution.—Alps and neighbouring portions of Germany, France and Italy; eastward through Tirol to the mountains of Transylvania.

Diagnosis.—Similar to *Sorex araneus bergensis*, but colour in summer pelage not so dark, the contrast between back and sides often not conspicuous, though back is frequently blackish: pigmentation of teeth more extensive than in the northern races, the hypocone of m^1 and m^2 usually brown at tip (see tabular comparison with true *araneus* on p. 36).

Measurements.—Average and extremes of eight specimens from the type locality: head and body, 75·8 (71–79); tail, 47·5 (45–50); hind foot, 13·5 (13·2–14·2). Average and extremes of twenty specimens from Andermatt, Uri, Switzerland: head and body, 73·1 (70–81); tail, 51·1 (50–55); hind foot, 13·3 (13–14). Measurements of an adult female from Zermatt, Valais, Switzerland (in alcohol):* head and body, 74·6; tail, 51; hind foot, 13·6. Average and extremes of three specimens from Vitznau, Switzerland:† head and body, 67·3 (62–72); tail, 46·3 (44–49); hind foot, 13·2 (12·8–13·6). Type of *Sorex araneus alticola* Miller (Meiringen, Switzerland, No. 85,930 U.S.N.M.): head and body, 76; tail, 55; hind foot, 14. Average and extremes of ten specimens from Meiringen, Switzerland:‡ head and body, 74·0 (70–77); tail, 52·5 (47–57); hind foot, 13·3 (13–14). Average and extremes of four specimens from Locarno, Ticino, Switzerland: head and body, 76·7 (76–82); tail, 48·5 (45–50); hind foot, 13·6 (13·4–13·8). For cranial measurements see Table, p. 49.

* Cotype of *Sorex vulgaris crassicaudatus* Fatio.

† Essentially topotypes of *Sorex vulgaris nigra* and *mollis* Fatio.

‡ Topotypes of *Sorex araneus alticola* Miller and essentially topotypes of *Sorex vulgaris nuda* Fatio.

Specimens examined.—Two hundred and sixty-two, from the following localities:—

FRANCE: Étupes, Doubs, 10; Barcelonnette, Basses-Alpes, 3; Chamonix, Haute-Savoie, 10 (U.S.N.M.).

GERMANY: Strassburg, 8.

SWITZERLAND: Geneva, 17 (U.S.N.M. and Mottaz); St. Cergues, Vaud, 19 (U.S.N.M. and Mottaz); Chesières, Vaud, 13 (Mottaz); Bioux-Dessus, Vaud, 4 (Mottaz); Les Plans, Vaud, 4 (U.S.N.M.); Zermatt, Valais, 7 (B.M., U.S.N.M. and Geneva); Stalden, Valais, 2 (Geneva); Grindelwald, Bern, 4 (U.S.N.M.); Brünig, Bern, 9 (U.S.N.M.); Meiringen, Bern, 17 (U.S.N.M.); Vitznau, Lucerne, 6 (B.M. and U.S.N.M.); Göschenen, Uri, 5 (U.S.N.M.); Andermatt, Uri, 49 (U.S.N.M.); Hospenthal, Uri, 1 (U.S.N.M.); Zürich, 1; Murgsee region, St. Gallen, 16 (U.S.N.M.); Degersheim, St. Gallen, 3 (U.S.N.M.); Uzwil, St. Gallen, 1 (U.S.N.M.); Sitterwald, St. Gallen, 5 (U.S.N.M.); Züberwangen, St. Gallen, 5 (U.S.N.M.); Wildkirchli, Appenzell, 1 (U.S.N.M.); Albulapass, Grisons, 1 (U.S.N.M.); Untervatz, Grisons, 5 (U.S.N.M.); Grisons, no exact locality, 4 (U.S.N.M.); Faido, Ticino, 3 (B.M. and U.S.N.M.); Lugano, Ticino, 1 (U.S.N.M.); Gentilino, Ticino, 1 (U.S.N.M.); Locarno, Ticino, 4; no exact locality, 1.

AUSTRIA-HUNGARY: Hatszeg, Hunyad, Transylvania, 10; Csallókőz-Somorja, Pressburg, Hungary, 3; Schwaz, Tirol, 2 (U.S.N.M.).

ITALY: Near Turin, 4 (Turin); Unerzio, Cuneo, 1; Vallombrosa, near Florence, 2.

8 ♂, 2 ♀.	Étupes, Doubs, 350 m. France. (*C. Mottaz*).	O. Thomas (P).	8. 8. 10. 14–24.
3 ♂.	Barcelonnette, Basses-Alpes. (*C. Mottaz.*)	O. Thomas (P).	8. 8. 10. 25–27.
4 ♂, 1 ♀.	Strassburg, Alsace. (*C. Mottaz.*)	O. Thomas (P).	8. 8. 10. 28–32.
1 al.	Zermatt, Valais, Switzerland.	Dr. J. Anderson (C & P).	91. 10. 15. 26.
3 ♂.	Vitznau, Lake Lucerne.	O. Thomas (C & P).	5. 8. 2. 32–34.
1 al.	Zurich.	C. Mösch (P).	89. 11. 8. 3
♀.	Faido, Ticino.	O. Thomas (C & P).	5. 8. 2. 19.
2 ♂, 2 ♀.	Locarno, Ticino.	O. Thomas (C & P).	5. 8. 2. 2–5.
♀.	Switzerland.	E. R. Alston (P).	79. 9. 25. 10.
8 ♂, 1 ♀.	Hatszeg, Hunyad, Transylvania, 1500–2000 ft. Hungary.	C. G. Danford (C).	3. 2. 2. 3–10. 3. 11. 8. 15.
3.	Csallókőz-Somorja, Pressburg, 400 ft. Hungary.	Budapest Museum (P).	94. 3. 1. 22–25.
2 al.	Vallombrosa, Florence, Italy.	Dr. G. Cecconi (C & P).	1. 8. 2. 2–3.

SOREX ARANEUS PYRENAICUS Miller.

1909. *Sorex araneus pyrenaicus* Miller, Ann. and Mag. Nat. Hist., 8th ser., III, p. 416, May, 1909. Type in British Museum.

1910. *Sorex araneus pyrenaicus* Trouessart, Faune Mamm. d'Europe, p. 53.

Type locality. — L'Hospitalet, Ariège, France. Altitude 4,700 feet.

Geographical distribution. — Pyrenees. At present known from France only, though occurring on the south slope of the mountains in the Department of Pyrénées-Orientales.

Diagnosis.—Very similar to *Sorex araneus tetragonurus*, but distinguishable by the duller, less evidently tricolored summer

pelage (winter coat not known), in which the back rarely if ever assumes the blackish-brown tints often seen in the Alpine form.

Colour.—The colour scarcely needs detailed description. As compared with that of the other large races it is characterised by extreme dulness and lack of noticeable contrast between the dorsal area and sides. In none of the thirty-two skins examined is the back so dark as in the dark individuals frequently found in Switzerland in summer.

Skull and teeth.—As in *S. araneus tetragonurus.*

Measurements.—External measurements of type: head and body, 72; tail, 51; hind foot, 14. Average and extremes of six specimens from the type locality: head and body, 70·6 (69–72); tail, 47 (44·4–51); hind foot, 13·3 (13–14). Average and extremes of nine specimens from Barèges, Hautes-Pyrénées: head and body, 72·5 (69–75); tail, 45 (42–49); hind foot, 13·3 (13–14). For cranial measurements see Table, p. 50.

Specimens examined.—Thirty-two, from the following localities in the French Pyrenees:—

Porté, Pyrénées-Orientales (Spanish watershed), 9; l'Hospitalet, Ariège, 12; Ax-les-Thermes, Ariège, 2; Barèges, Hautes-Pyrénées, 9.

Remarks.—In its dull colour the Pyrenean shrew differs from the other large members of the group in much the same way as the small *Sorex araneus euronotus* of the neighbouring lowlands differs from true *araneus.* It thus represents the opposite extreme from the dark Norwegian form.

♂, ♀.	Porté, Pyrénées-Orientales, 1600 m. France.	G. S. Miller (c).	8. 8. 4. 142–143.
2 ♂, ♀.	Porté, Pyrénées-Orientales, 1600–1700 m. (*A. Robert*).	O. Thomas (p).	8. 9. 1. 49–51.
♂, 4 ♀.	L'Hospitalet, Ariège, 4700 ft.	G. S. Miller (c).	8. 8. 4. 151–154. 301. (8. 8. 4. 301. *Type* of subspecies.)
♀.	Ax-les-Thermes, Ariège, 2600 ft.	G. S. Miller (c).	8. 8. 4. 141.
♂, 6 ♀.	Barèges, Hautes-Pyrénées, 1300–1500 m.	G. S. Miller (c).	8. 8. 4. 144–150.

Sorex araneus fretalis Miller.

1909. *Sorex araneus fretalis* Miller, Ann. and Mag. Nat. Hist., 8th ser., III, p. 416, May, 1909. Type in British Museum.

1910. *Sorex araneus fretalis* Trouessart, Faune Mamm. d'Europe, p. 52.

Type locality.—Trinity, Jersey, Channel Islands.

Geographical distribution. Known only from the island of Jersey.

Diagnosis.—Like *Sorex araneus araneus*, but skull with rostral portion shortened, broadened and deepened, and anterior

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Lachrymal breadth.	Length of palate.	Depth of braincase (basi-occipital).	Mandible.	Maxillary tooth-row (exclusive).	Mandibular tooth-row (centres).	Observations.
S. araneus araneus.											
Sweden: Upsala	84913	♂	18·8	5·2	4·0	9·6	5·4	9·1	8·2	7·4	Teeth much worn.
,,	84914	♂	19·0	5·0	3·8	9·8	5·0	10·0	8·2	7·6	,, ,,
,,	84915	♂	18·8	5·2	3·8	9·6	5·0	10·0	8·4	7·8	,, ,,
,,	84922	♂	—	5·2	3·6	—		10·0	8·8	8·0	,, not worn.
,,	84943	♂	18·2	5·0	3·4	9·4	5·4	9·8	8·4	7·8	,, slightly worn.
,,	84944	♂	18·8	5·4	3·6	9·2	5·2	10·0	8·2	7·6	,, much worn
,,	84961	♂	18·8	5·4	3·8	9·0	5·2	10·0	8·2	7·6	,, moderately worn.
,,	84985	♂	19·0	5·2	3·6	9·2	5·2	10·0	8·2	7·6	,, much worn.
,,	84986	♂	19·2	5·2	3·6	9·6	5·4	10·0	8·4	7·8	,, ,,
,,	84912	♀	18·8	4·8	3·6	9·0	5·2	9·8	8·2	7·8	,, not worn.
,,	84916	♀	19·0	5·2	3·8	9·2	5·6	10·0	8·6	8·0	,, ,,
,,	84918	♀	19·2	5·2	3·8	9·6	5·4	10·0	8·8	8·0	,, ,,
,,	84925	♀	19·0	5·0	4·0	9·4	5·6	9·8	8·2	7·6	,, ,,
,,	84928	♀	18·8	5·2	3·8	9·8	5·6	10·2	8·8	8·2	,, ,,
,,	84929	♀	19·0	5·2	4·0	9·8	5·8	10·0	8·8	8·0	,, ,,
,,	84934	♀	18·8	5·0	3·8	9·2	5·2	9·8	8·6	8·0	,, ,,
,,	84935	♀	18·2	5·2	3·8	9·6	5·2	9·8	8·2	7·8	,, slightly worn.
,,	84948	♀	18·0	5·0	3·6	9·2	5·2	9·8	8·4	8·0	,, ,,
,,	84952	♀	18·6	5·2	3·6	9·2	5·2	10·0	8·6	7·8	,, ,,
,,	84960	♀	18·4	5·0	3·6	9·2	5·4	10·0	8·6	8·0	,, not worn.
Norway: Mölmen	98. 5. 2. 1	♂	19·0	5·2	4·0	9·0	4·8	9·8	8·4	8·0	,, slightly worn.
,,	98. 5. 2. 2	♀	19·2	5·6	4·0	9·8	4·4	10·2	8·8	8·2	,, ,,
Holaaker	98. 2. 28. 1	♂	19·0	5·2	4·0	9·8	4·8	10·0	8·6	8·0	,, ,,
,,	98. 2. 28. 2	♂	19·0	5·2	3·8	9·4	4·6	10·0	8·4	7·8	,, ,,
Eggedal	115330	♀	18·8	5·2	3·8	9·4	—	10·0	8·4	8·0	,, ,,
Asker	105115	♀	18·2	5·4	3·6	9·4	4·8	9·4	8·8	7·8	,, ,,
,,	105117	♀	18·0	5·2	3·6	9·2	5·0	9·8	8·2	8·0	,, ,,
Denmark: Hilleröd	98. 6. 7. 3	♂	18·8	5·4	4·0	10·0	5·6	10·0	8·0	7·4	,, moderately worn.

Denmark: Hillerod . . .	98. 6. 7. 4	♂	18·6	5·4	4·0	9·6	5·4	9·8	8·0	7·2	Teeth moderately worn.
,, . . .	98. 6. 7. 5	♂	18·8	5·4	3·8	9·6	5·4	10·0	8·0	7·8	,, ,,
Nysted, Lolland . .	141693	♂	18·4	5·0	3·8	9·6	5·6	10·0	8·2	7·6	,, much worn.
,, ,, . .	141694	♀	18·6	5·2	4·0	9·6	5·4	9·8	8·4	7·6	,, ,,
Skansen ,, . .	141695	♂	18·8	5·2	3·8	9·8	6·0	9·8	8·6	8·0	,, not worn.
Holland: Oosterbeek . . .	98. 2. 1. 6	♂	18·4	5·6	3·8	9·6	5·2	9·8	8·2	8·0	,, ,,
Leiden	152378	♂	18·8	5·2	3·4	9·4	5·0	9·8	8·0	7·6	,, moderately worn.
,, ...	152379	♀	—	5·4	3·6	—	—	10·0	8·2	7·4	,, slightly worn.
,, ...	152380	♀	18·8	5·2	3·4	9·4	5·0	10·0	8·6	7·8	,, ,,
Belgium: Waremme, Liége .	86011	♀	17·8	5·4	3·6	9·2	5·0	9·6	8·2	7·6	,, ,,
,, ,, . .	86012	♂	18·2	5·2	3·6	9·0	5·0	9·8	7·8+	7+	,, much worn.
,, ,, . .	86014	♀	18·6	5·6	3·4	9·2	4·8	10·0	8·4	7·6	,, slightly worn.
France: Manonville, Meurthe-et-Moselle . . .	152385	♂	18·4	5·6	3·8	—	5·0	9·6	8·2	7·8	,, ,,
,, ,,	152386	♀	18·8	5·6	3·6	9·2	4·8	10·0	8·6	8·0	,, ,,
Barbizon, Seine-et-Marne	172112	♀	18·8	5·8	3·8	9·2	4·8	10·0	8·2	7·6+	,, much worn.
Germany: Brunswick . . .	85391	♂	18·8	5·2	3·8	9·8	5·2	10·2	8·4	8·0	,, not worn.
,, . . .	85405	♂	18·2	5·2	3·8	9·4	4·8	9·6	8·0	7·2+	,, much worn.
,, . . .	85399	♀	18·4	5·2	3·8	9·6	5·0	10·0	8·0	7·4+	,, ,,
,, . . .	85400	♀	18·6	5·2	3·6	9·2	5·0	10·0	8·4	8·0	,, slightly worn.
,, . . .	85402	♀	17·8	5·0	3·6	9·0	5·0	9·4	8·0	7·6	,, ,,
,, . . .	85403	♀	18·0	5·4	3·8	9·4	5·2	9·6	8·2	7·6	,, ,,
,, . . .	85404	♀	18·4	5·2	4·0	9·4	5·0	9·2	8·4	8·0	,, ,,
,, . . .	85408	♀	18·2	5·2	3·8	9·4	5·0	9·6	8·4	7·8	,, ,,
,, . . .	85409	♀	18·2	5·2	3·8	9·6	5·4	9·8	8·2	7·8	,, ,,
Bahrenberg, Harz Mts. .	112936	♂	18·2	5·0	3·6	9·0	5·0	9·4	8·2	7·8	,, ,,
,, ,, ,, .	112938	♂	18·0	5·2	3·8	9·2	5·0	9·2	8·0	7·6	,, moderately worn.
,, ,, ,, .	112942	♂	18·2	5·2	3·8	9·4	5·0	9·6	8·4	8·0	,, slightly worn.
,, ,, ,, .	112937	♀	18·4	5·2	3·8	9·4	5·2	9·8	8·4	8·0	,, ,,
,, ,, ,, .	112941	♀	18·2	5·2	3·8	9·4	5·0	9·4	8·4	8·0	,, ,,
Bodethal, Harz Mts. .	112956	♂	18·2	5·2	3·8	9·0	4·8	9·0	7·8+	7·2+	,, much worn.
,, ,, ,, .	112964	♂	18·8	5·4	4·0	9·6	5·0	10·0	8·6	8·0	,, slightly worn.
,, ,, ,, .	112957	♀	18·8	5·4	3·8	9·4	5·2	9·8	8·8	8·0	,, ,,
,, ,, ,, .	112958	♀	17·8	5·0	3·8	9·0	5·0	9·2	8·0	7·8	,, ,,
,, ,, ,, .	112959	♀	19·2	5·2	4·0	9·4	5·0	9·8	8·6	7·2+	,, much worn.
,, ,, ,, .	112961	♀	18·6	5·2	3·6	9·2	5·0	9·6	8·4	7·8	,, slightly worn.
,, ,, ,, .	112963	♀	18·2	5·2	4·0	9·6	5·0	9·4	8·6	7·8	,, ,,
near Königsberg . .	112265	♂	18·6	5·2	4·0	9·8	5·6	9·6	8·6	8·0	,, ,,
,, ,, . .	112268	♀	18·8	5·2	3·6	9·4	5·2	9·8	8·4	7·8	,, ,,

* Distance between tips of rudimentary zygomatic processes.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case (median).	Mandible.	Maxillary tooth-row (entire).	Mandibular tooth-row (entire).	Observations.
S. araneus araneus (*continued*).											
Germany: near Sneekoppe, Riesengebirge	112944	♀	18·8	5·2	4·0	.	—	10·0	8·6	8·2	Teeth slightly worn.
,, ,,	112945	♀	18·4	5·0	3·6	9·4	5·4	9·8	8·4	7·8	,, ,,
,, ,,	112946	♀	18·6	5·2	3·8	9·6	5·2	10·0	8·6	8·0	,, ,,
,, ,,	112947	♀	18·4	5·4	3·8	9·6	5·2	10·0	8·6	8·0	,, ,,
,, ,,	112950	♀	18·2	5·2	3·8	9·4	5·4	9·8	8·6	8·0	,, ,,
,, ,,	112969	♀	19·0	5·4	4·0	—	5·0	10·0	8·8	8·0	,, ,,
,, ,,	112970		18·6	5·2	3·8	9·8	5·2	10·0	8·6	8·0	,, ,,
S. araneus castaneus.											
Scotland: Black Isle, Cromarty	11. 1. 3. 109	♀	18·8	5·2	3·8	9·6	5·4	9·6	8·4	8·0	,, not worn.
,, ,,	11. 1. 3. 111	♀	18·8	5·4	4·0	9·4	5·2	9·8	8·4	8·0	,, ,,
,, ,,	11. 1. 3. 104	♂	19·0	5·6	3·8	9·6	5·0	10·2	8·4	7·8	,, moderately worn.
,, ,,	11. 1. 3. 105	♂	18·8	5·2	4·0	9·4	5·0	10·0	8·2	8·0	,, not worn.
,, ,,	11. 1. 3. 110		19·2	5·2	3·8	9·4	5·2	10·0	8·2	8·0	,, moderately worn.
Cromlix	11. 1. 3. 116	♀	19·0	5·2	3·8	9·4	5·4	10·0	8·4	8·0	,, not worn.
,,	11. 1. 3. 117	♀	19·0	5·2	3·6	9·2	5·0	9·6	8·6	8·0	,, ,,
,,	11. 1. 3. 118	♀	18·8	5·2	3·8	9·0	5·0	9·8	8·4	8·0	,, ,,
,,	11. 1. 3. 119	♀	18·0	5·0	3·8	9·0	5·2	9·2	8·0	7·8	,, ,,
,,	11. 1. 3. 114	♂	19·0	5·2	3·8	9·4	5·0	10·0	8·2	7·8	,, ,,
,,	11. 1. 3. 115	♂	18·6	5·2	3·8	9·2	5·4	9·6	8·2	7·8	,, ,,
Morayshire	79. 9. 25. 79	♂	17·8	5·2	3·6	9·0	4·8	9·0	8·0	7·2	,, slightly worn.
England: Grimsby, Lincolnshire	11. 1. 3. 124	♀	19·0	5·4	3·8	9·8	5·4	10·0	8·6	8·0	,, not worn.
,, ,,	11. 1. 3. 126	♀	19·0	5·4	3·6	9·8	5·0	10·0	8·6	7·8	,, slightly worn.
,, ,,	11. 1. 3. 128	♀	19·0	5·6	3·8	9·4	5·4	10·2	8·6	8·0	,, ,,
,, ,,	11. 1. 3. 125		19·2	5·6	3·8	9·6	5·0	10·2	8·8	8·0	,, ,,
Swithland, Leicestershire	11. 1. 3. 132	♀	19·0	5·6	3·8	9·2	5·0	10·0	8·8	8·0	,, not worn.

England: Swithland, Leicestershire	11. 1. 3. 134	♀	19·0	5·2	3·8	9·4	4·4	9·6	8·0	7·8	Teeth slightly worn.
Bardsey Island, Carnarvonshire		♀	17·8	5·2	3·6	9·0	4·8	9·2	8·0	7·2	„ moderately worn.
S. araneus tetragonurus.											
Germany: Strassburg	8. 8. 10. 31	♂	20·2	5·6	4·2	10·0	5·2	10·4	9·0	8·4	„ „
„	8. 8. 10. 32	♀	19·8	5·8	4·0	10·0	5·4	10·2	8·6	8·0	„ „
France: Étupes, Doubs	152405	♂	19·4	5·6	4·0	9·4	5·2	10·4	8·8	8·0	„ slightly worn.
„ „	8. 8. 10. 14	♂	19·4	5·8	4·0	9·6	5·0	10·0	8·8	8·0	„ „
„ „	152404	♂	20·0	5·6	4·0	9·4	5·0	10·4	9·0	8·0	„ „
„ „	8. 8. 10. 15	♂	19·8	5·6	4·0	10·0	5·0	10·6	9·0	8·2	„ „
„ „	8. 8. 10. 16	♂	19·8	5·6	3·8	9·8	5·2	10·2	8·8	8·0	„ „
„ „	152406	♂	20·0	5·6	4·0	9·6	5·0	10·6	9·0	8·4	„ „
„ „	8. 8. 10. 18	♂	20·0	5·6	3·8	9·8	5·0	10·4	9·0	8·2	„ „
„ „	8. 8. 10. 19	♂	19·8	6·0	4·0	9·8	5·0	10·4	9·0	8·0	„ „
„ „	152408	♂	20·0	5·8	4·0	10·0	5·0	10·4	9·0	8·2	„ „
„ „	152409	♀	19·8	5·6	4·0	9·6	5·0	10·2	9·0	8·2	„ „
„ „	8. 8. 10. 24	♀	19·2	5·4	4·0	9·2	5·0	10·2	8·8	8·0	„ not worn.
Barcelonnette, Basses-Alpes	8. 8. 10. 27	♂	20·0	5·6	4·0	9·6	5·0	10·0	9·0	8·4	„ „
„ „	152403	♂	19·8	5·8	4·0	9·8	5·2	10·0	9·0	8·2	„ „
Switzerland: St. Cergues, Vaud	124457	♀	19·0	5·4	3·8	9·8	5·2	10·0	9·0	8·4	„ slightly worn.
„ „	124461	♀	19·8	5·2	3·6	9·4	5·4	10·2	9·0	8·4	„ „
„ „	124462	♀	20·0	5·4	3·6	9·8	5·6	10·4	9·0	8·2	„ „
„ „	124466	♀	19·6	5·6	3·8	9·6	5·4	10·2	9·0	8·2	„ „
Meiringen	85921	♂	20·2	5·4	4·0	9·8	5·0	10·2	9·0	8·4	„ „
„	85923	♂	20·2	5·4	4·0	9·6	5·4	10·4	9·0	—	„ „
„	85930*	♂	20·2	5·6	3·8	9·6	5·4	10·4	9·2	8·4	„ „
„	85932	♂	20·0	5·4	3·8	9·2	5·0	10·2	9·2	8·6	„ „
„	85935	♂	20·2	5·6	4·0	10·0	5·0	10·6	9·0	8·0	„ not worn.
„	85927	♀	19·0	5·4	4·0	10·2	5·4	10·0	8·8	8·0	„ much worn.
„	85929	♀	20·2	5·6	4·0	9·6	5·6	10·8	9·0	8·6	„ not worn.
„	85931	♀	20·0	5·4	4·0	9·6	5·6	10·0	9·0	8·4	„ „
„	85934	♀	20·6	5·4	4·0	9·8	5·6	10·6	9·2	8·6	„ „
Andermatt, Uri	85756	♀	19·0	5·2	3·6	9·6	5·2	9·4	8·4	7·8	„ slightly worn.
„ „	65757	♀	19·4	5·2	3·8	9·2	5·2	9·8	8·6	8·0	„ not worn.
„ „	85768	♀	19·2	5·2	3·8	9·6	5·0	9·6	8·6	8·0	„ „
„ „	85777	♀	19·0	5·2	3·8	9·2	5·0	9·0	8·2	7·2	„ much worn.
„ „	85778	♀	19·6	5·2	3·8	9·6	5·2	9·8	8·6	8·0	„ not worn.

* Type of *Sorex araneus alticola* Miller.

CRANIAL MEASUREMENTS OF *SOREX ARANEUS* *continued.*

Locality.	Number.	Sex.	Condylo-basal length.	Zygomatic breadth.	Intertemporal breadth.	Length of upper tooth-row.	Depth of mandibular ramus behind m.1.	Mandible.	Maximum breadth across condyles.	Maximum breadth across angles.	Observations.
S. araneus tetragonurus (*continued*).											
Switzerland. Zermatt	712. 32. 6. 7 = Geneva*	♂	19·6	5·4	3·8	9·6	5·4	9·6	8·6	8·0	Teeth not worn.
,,	124539	♂	19·0	5·2	3·8	9·2	5·2	9·4	8·8	8·0	,, slightly worn.
no exact locality	712. 15. 6. 7 = Geneva†							10·8		8·8	,, ? ,,
Austria-Hungary: Schwaz, Tirol	112834		19·4	5·4	4·0	9·8	5·4	10·0	8·8	8·0	,, ,,
,, ,,	112835		19·4	5·4	4·0	9·8	5·2	10·2	8·8	8·4	,, ,,
Hatszeg, Hunyad	3. 2. 2. 3	♀	19·2	5·2	4·2	9·4	5·0	10·6	8·6	8·0	,, ,,
,, ,,	3. 2. 2. 1‡	♀	19·4	5·4	4·0	9·6	5·2	10·0	8·8	8·0	,, ,,
,, ,,	3. 2. 2. 6	♀	19·0	5·4	4·0	9·6	5·0	10·0	8·8	8·0	,, ,,
,, ,,	3. 2. 2. 7	♀	19·0	5·4	4·0	9·4	4·8	9·8	8·8	8·0	,, ,,
,, ,,	3. 11. 8. 12	♀	19·6	5·4	4·2	9·4	5·0	10·4	8·2	7·2	,, much worn.
,, ,,	3. 11. 8. 11	♂	19·0	5·4	4·0	9·8	5·0	10·0	8·0	7·2	,, ,,
S. araneus pyrenaicus.											
Ax-les-Thermes, Ariège	172107	♀	19·8		4·2	10·0	5·4	10·4	9·0	8·0	,, slightly worn.
,, ,,	8. 8. 1. 141	♀	—	5·6	4·0	—		10·2	9·0	8·0	,, ,,
l'Hospitalet, Ariège	8. 8. 1. 152	♀	19·4	5·4	3·8	9·8	5·2	10·2	8·8	8·0	,, ,,
,, ,,	8. 8. 1. 153	♀	19·4	5·6	3·8	9·6	5·0	10·0	8·6	8·0	,, not worn.
,, ,,	8. 8. 1. 301§	♀	20·0	5·6	4·0	9·8	5·1	10·2	9·0	8·0	,, ,,
,, ,,	172103	♂	19·6	5·4	3·8	9·4	5·2	10·0	9·0	8·0	,, ,,
,, ,,	8. 8. 1. 151	♂	20·0	5·4	3·8	9·6	5·2	10·0	8·8	8·0	,, slightly worn.
Porté, Pyrénées Orientales	172109	♂	20·0	5·6	3·8	9·2	5·2	10·0	8·8	8·0	,, not worn.
,, ,, ,,	8. 8. 1. 142	♂	19·6	5·6	3·8	9·4	5·3	10·2	8·8	8·0	,, ,,
,, ,, ,,	8. 8. 1. 143	♀	19·4	5·4	4·0	10·0	5·4	10·0	8·8	8·0	,, ,,
Bareges, Hautes Pyrénées	8. 8. 1. 144	♂	20·0	6·0	4·0	10·0	5·4	10·6	9·0	8·0	,, ,,
,, ,, ,,	172111	♂	19·6	6·0	4·0	10·0	5·4	10·2	8·8	8·0	,, ,,
,, ,, ,,	8. 8. 1. 146	♀	19·0	5·8	4·2	9·6	5·2	10·0	8·8	8·0	,, slightly worn.
,, ,, ,,	172110	♀	19·2	5·8	4·0	9·8	5·4	9·8	8·6	8·0	,, ,,

Bagnères, Hautes Pyrénées	8 8 4 147	♀	19·6	5·8	4·0	9·8	5·0	10·0	8·8	8·0	Teeth slightly worn.		
.. .. ..	8 8 4 148	♀	20·8	5·8	4·0	10·0	5·6	10·2	8·8	8·0	..	..	
.. .. ..	8 8 4 149	♀	19·4	5·6	4·0	9·4	5·0	10·0	8·6	8·0	..	not worn.	
.. .. ..	8 8 4 150	♀	19·0	5·8	3·8	9·6	5·0	10·0	8·6	7·8	..	..	
S. araneus bergensis.													
Norway S8jærdal, Nordfjord	8 1 5 1	♂	19·2	5·2	3·8	9·6	5·2	9·8	8·6	8·0	..	..	
.. ..	8 1 5 2	♀	19·4	5·2	4·0	9·6	5·2	10·0	8·8	8·0	..	..	
.. ..	8 1 5 4	♀	19·6	5·4	4·0	9·8	5·4	10·0	8·8	8·0	..	..	
.. ..	8 1 5 5	♀	19·8	5·4	4·0	10·0	5·2	10·2	8·6	8·0	..	much worn.	
.. ..	1934[illegible]	♀	19·6	5·2	4·0	10·0	5·6	10·6	9·0	8·4	..	not worn	
Bergen . . .	84069	♂	19·0	5·0	3·8	9·8	5·4	10·0	8·4	7·8	..	slightly worn	
.. .	84080	♂	19·6	5·2	4·0	10·0	5·4	10·4	8·6	7·8+	..	much worn.	
Gravim. Hardanger	8483	♀	19·-	5·6	4·0	10·0	—	10·4	8·4	8·0	..	moderately worn.	
.. ..	84864§	♀	19·4	5·6	4·0	10·0	5·2	10·2	8·6	8·0	..	..	
.. .. .	84870	♂	19·0	5·2	3·8	9·4	5·0	10·0	8·4	7·8+	..	much worn.	
S. araneus fretalis.													
Channel Islands Trinity, Jersey	8 9 2 2 1§	♀	18·8	6·2	4·0	9·4	5·2	10·0	8·4	7·8	..	not worn.	
.. ..	192428		18·2	6·2	4·0	9·6	5·2	10·0	8·6	8·0	..	..	
St. Ouen's Bay	8 9 2 2 2	♂	18·4	6·0	4·0	9·0	5·0	10·0	8·2	7·2+	..	much worn.	
S. araneus santonus.													
France Charente	Gr. 170 Motta.	♂	18·6	5·6	4·0	10·0	5·4	10·0	8·2	7·8	..	moderately worn.	
..	Gr. 172		18·0	5·6	3·8	9·2	4·8	9·6	8·0	7·2	..	..	
..	Gr. 192		18·4	5·4	4·0	9·2	4·8	10·0	8·2	7·4	..	..	
..	Gr. 210		18·4	5·8	3·8	9·2	4·8	10·0	8·2	7·4	..	..	
..	Gr. 211		—	—	—	—	—	9·8	8·4	7·8	..	slightly worn	
S. araneus euronotus.													
France Montluçon	101821§	♂	18·6	5·6	3·9	9·0	5·2	10·0	8·4	7·8	..	..	
.. .	101822	♂	18·4	5·6	3·6	9·0	5·0	9·8	8·4	7·8	..	..	
.. .	101815	♀	18·6	5·6	4·0	9·2	4·8	10·0	8·8	8·0	..	..	
S. araneus granarius.													
Spain La Granja, Segovia	6 11 4 3	♂	17·4	5·2	4·0	9·2	4·8	9·0	7·4	6·8	..	much worn	
.. .. .	6 11 4 4§	♂	17·6	5·4	4·0	9·0	5·0	9·0	7·6	7·0	..	moderately worn	

* Co-type of *Sorex araneus euronotus* Fatio.
† Type of *Sorex fretalis inhabitans* Barrett-Hamilton.
‡ Type of *Crossopus santonus* Fatio.
§ Type.

teeth (incisors both above and below, and first and second upper unicuspids) enlarged.

Colour.—Summer pelage about like that of *S. araneus araneus*, but upper parts perhaps not so dark. Sides apparently averaging lighter than in true *araneus*, and underparts in some specimens a very pale, almost whitish, buffy grey, decidedly lighter than in any skins of the other races yet examined.

Skull.—In size and general form the skull does not differ appreciably from that of true *Sorex araneus*, but on comparison of specimens the rostral portion in front of large premolar is seen to be relatively shorter, broader and deeper. The greater breadth is especially noticeable from below, the space between the anterior unicuspids about equalling diameter of these teeth, while in all the other races (except *S. a. granarius*) it is evidently less.

Teeth.—While in general the teeth resemble those of *Sorex araneus araneus*, the large incisors both above and below are appreciably more robust, and the first and second upper unicuspids are wider. The difference is particularly noticeable in the lower incisor, the shaft of which is thickened and the lobes on cutting edge distinctly enlarged.

Measurements.—External measurements of type (adult female): head and body, 63; tail, 48·2; hind foot, 13. For cranial measurements see Table, p. 51.

Specimens examined.—Five, all from the island of Jersey.

Remarks.—The Jersey shrew is easily distinguishable from the other races by its enlarged anterior teeth. It is probable that a sufficient series of skins will show that there is an average difference in colour as well.

♀, ♂.	Jersey, Channel Islands. (*R. H. Bunting.*)	O. Thomas (F). (8. 9. 2. 1. *Type* of subspecies.)	8. 9. 2. 1–2.

Sorex araneus granarius Miller.

1910. *Sorex araneus granarius* Miller, Ann. and Mag. Nat. Hist., 8th ser., VI, p. 459, November, 1910. Type in British Museum.

Type locality.—La Granja, Segovia, Spain.

Geographical distribution.—At present known from the type locality only, and probably confined to the mountains of central Spain.

Diagnosis.—Smallest known European race of *Sorex araneus*, the condylobasal length of skull only about 17·5 mm., upper tooth-row about 7·5 mm.; palate wide anteriorly as in *S. araneus fretalis*, but anterior teeth not enlarged.

External characters and colour.—Externally the animal shows no special peculiarities, though the ear and the plantar tubercles

seem to be relatively smaller than usual. Colour of specimens in alcohol apparently as in true *araneus*.

Skull and teeth.—Apart from its small size the skull does not differ noticeably from that of the other races, except in the relative shortness of the rostral portion and tooth-row as compared with the breadth of palate. Palatal breadth between anterior unicuspids as great in proportion to width of teeth as in *S. araneus fretalis*. Teeth small, normal in form, the pigmentation apparently less extensive than usual.

Measurements.—Type (adult male), and an older male, also from La Granja: head and body, 62 and 66; tail, 36 and 37; hind foot, 11·6 and 11·6; ear from meatus, 6·6 and 7. For cranial measurements see Table, p. 51.

Specimens examined.—Two, both from the type locality.

Remarks.—In its broad palate the Guadarrama shrew bears a remarkable likeness to the form inhabiting the island of Jersey. It is readily distinguishable from the Jersey animal by its small size, and by the absence of all tendency to enlargement of the anterior teeth.

2 al. La Granja, Segovia, Spain. M. de la Escalera (c). 6. 11. 4. 3–4. (6. 11. 4. 4. *Type* of subspecies.)

SOREX MINUTUS Linnæus.

(Synonymy under subspecies.)

Geographical distribution.—Northern portion of Eurasia from Ireland eastward (exact eastern limits of range not known). In Europe south to the Pyrenees and southern Italy.

Diagnosis.—Size small, head and body usually about 50–60 mm., the tail 10–15 mm. shorter, condylobasal length of skull 14·8–16·6 mm.; posterior lobe of anterior upper incisor sub-terete, the length of its base about half that of anterior cusp; colour brown, the underparts always lighter than back, and sides never specially contrasted.

External characters.—In general external characters *Sorex minutus* agrees with *S. araneus*, except for its smaller size and relatively longer tail.

Colour.—The colour rather closely resembles that of *Sorex araneus* in dull summer pelage, except that the back usually has a peculiar greyish cast not easy to describe, but by which it is possible to recognise skins with much certainty. There is never any indication of a specially differentiated colour area along sides. Upper parts between sepia and wood-brown in summer, more nearly hair-brown in winter, the hairs slate-grey at base and with faint silvery sub-terminal annulations more visible in some lights than in others, and giving rise to the greyish effect already alluded to. Underparts smoke-grey of varying depth, some-

times almost whitish, the line of demarcation along sides usually evident though not very conspicuous. Feet pale wood-brown with a silvery gloss or suffused with drab, sometimes noticeably lighter than back. Tail concolor with back above, not so dark below.

Skull.—Apart from its conspicuously smaller size (condylo-basal length, 14·8 to 16 mm. instead of 17·8 to 20 mm.) the skull differs notably from that of *Sorex araneus* and *S. alpinus* in the narrower, more elongate brain-case, the outline of which when viewed from above is distinctly oval instead of sub-circular. Antero-external portion of border flattened, though less noticeably than in *Sorex araneus*. Owing to its different form the brain-case is less abruptly marked off from interorbital region than in the other European species. Depth of brain-case usually less relatively to breadth than in *S. araneus*. Lachrymal foramen opening over posterior half of first molar.

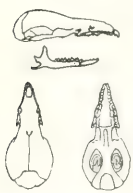

FIG. 10.
Sorex minutus. Nat. size.

Teeth.—Aside from their very much smaller size (upper tooth-row 6 to 7 mm. instead of 8 to 9·6 mm.) the teeth of *Sorex minutus* differ in numerous details of form from those of *S. araneus*. Anterior upper incisor with basal lobe nearly as high as anterior cusp, so that the two points of the tooth are essentially in line with the tips of the first three unicuspids. When viewed from below the posterior lobe appears, however, distinctly smaller than anterior cusp, while from the side its outline is conspicuously higher and narrower than that of first unicuspid. Anterior lower incisor with first lobe on cutting edge as well defined from anterior point of tooth as from second lobe, and lengths of bases of all three lobes approximately equal. Upper unicuspids not essentially different in form from those of *Sorex araneus*, but crowns perceptibly longer than wide and less abruptly rounded off anteriorly, the resulting form less nearly square. In lateral view the outline is quite as in the larger animal. The relative size of the unicuspids differs markedly from that in the larger animal. The first, second and third are sub-equal, with the second usually a trifle smaller than the third, and the first with distinctly the greatest crown area. Fourth slightly smaller than third, and fifth equally smaller than fourth*, between which and large premolar it is tightly crowded. First lower unicuspid differing from that of *S. araneus* in its greater length along cingulum and less height of cusp, its form when viewed from

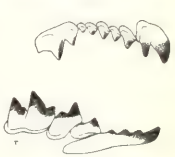

FIG. 11.
Sorex minutus. Anterior teeth in profile. × 5.

* Sometimes equal to fourth or slightly larger.

the side thus noticeably different from that of first upper unicuspid. Second unicuspid, together with other mandibular teeth, essentially as in *S. araneus*. Maxillary cheek-teeth as in *S. araneus*, except that hypocones are less developed, that on large premolar obsolete.

Remarks.—*Sorex minutus* is at once distinguishable from *S. araneus* by its smaller size and relatively longer tail, as well as by the more technical characters of the skull and teeth. Immature individuals of *araneus* might sometimes be mistaken for *minutus*, but their larger feet will serve to indicate their identity; while if the skull and teeth can be examined, a positive identification is easily obtained.

Sorex minutus minutus Linnæus.

1766. [*Sorex*] *minutus* Linnæus, Syst. Nat., I, 12th ed., p. 73 (Siberia).
1769. *Sorex pygmæus* Laxmann, Sibirische Briefe, p. 72 (Barnaul, Tomsk, Siberia).
1789. [*Sorex*] *exilis* Gmelin, Syst. Nat., I, 13th ed., p. 115 (Yenesei River, Siberia).
1806. *Sorex canaliculatus* Ljungh, Kongl. Vetensk. Akad. Nya Handl., XXVII, p. 263 (Lommaryd Vicarage, northern Vedbo district, Jönköping, Sweden).
1811. *Sorex pygmæus* Pallas, Zoogr. Rosso-Asiat., I, p. 134 (Ob and Yenesei Rivers, Siberia).
1811. *Sorex minimus* Geoffroy, Ann. Mus. d'Hist. Nat., Paris, XVII, p. 186 (Accidental renaming of *minutus*).
1832. *Sorex pumilio* Wagler, Isis, p. 54 (Bavaria).
1838. *S*[*orex*] *rusticus* Jenyns, Ann. Nat. Hist., I, p. 423, August, 1838 (England).
1838. *S*[*orex*] *rusticus* var. β *S*[*orex*] *hibernicus* Jenyns, Ann. Nat. Hist., I, p. 423, August, 1838 (Dublin, Ireland).
1844. *Sorex pumilus* Nilsson. Öfversigt af Kongl. Vetensk.-Akad. Förhandl., Stockholm, I, p. 33, March 20, 1844 (North-eastern Skaane, Sweden).
1857. *Sorex pygmæus* Blasius, Säugethiere Deutschlands, p. 133.
1895. *Sorex minutus* Thomas, The Zoologist, 3rd ser., XIX, p. 63, February, 1895.
1910. *Sorex minutus* Trouessart, Faune Mamm. d'Europe, p. 55.

Type locality.—Vicinity of the Yenesei River, Siberia.

Geographical distribution.—The entire European range of the species, except southern Italy.

Diagnosis.—Teeth normal in size, the molars and anterior upper incisor not enlarged.

Measurements.—Average and extremes of thirteen specimens from Grantown-on-Spey, Elgin, Scotland: head and body, 52·3 (49–55); tail, 36 (32·5–39·5); hind foot, 10·4 (10–11). Average and extremes of eight specimens from the Isle of Man: head and body, 59·6 (52–64); tail, 40·2 (36–43); hind foot, 11·1 (10–12). Average and extremes of five specimens from Ariège, France: head and body, 55·8 (51–62); tail, 44·2 (42–46); hind foot, 11·4 (11–12). Average and extremes of

four specimens from the Harz Mountains, Germany: head and body, 57·3 (51–63); tail, 40·5 (39–42); hind foot, 11·5 (11–12). Average and extremes of four specimens from Stalden, Valais, Switzerland: head and body, 55·6 (50–61); tail, 42·6 (42–43); hind foot, 11·0 (10·8–11·2). Average and extremes of seven specimens from Hatszeg, Hunyad, Transylvania: head and body, 51·3 (47–55); tail, 40·6 (32–46); hind foot, 11·2 (10–12). For cranial measurements see Table, p. 58.

Specimens examined.—One hundred and twenty-five, from the following localities:—

SCOTLAND: Lossiemouth, Elgin, 2; Gordonstown, Elgin, 1; Lhanbryde, Elgin, 2; Grantown-on-Spey, Elgin, 13; Cromlix, Dunblane, 1; Aberdeen, 1; Dunvegan, Skye, 1; Stornoway, Lewis, Hebrides, 1; Newton, North Uist, Hebrides, 1; Barra Island, Hebrides, 1; Stockbriggs, Lanarkshire, 1; Kirtle Bridge, Dumfriesshire, 1; Wyseby, Dumfriesshire, 2.

WALES: Aberia, Merionethshire, 2; near Bridgend, Glamorganshire, 1; no exact locality, 1.

ENGLAND: Spurn Head, Yorkshire, 1; Grimsby, Lincolnshire, 3; Waltham, Lincolnshire, 2; Thornhaugh, Northants, 2; Swithland, Leicestershire, 1; Graftonbury, Herefordshire, 2; Crippetts, Gloucestershire, 3; Clifton, Gloucestershire, 1; Loughton, Essex, 2; Wilbraham, Cambridgeshire, 1; Dartford, Kent, 1; New Forest, Hampshire, 1; Alum Bay, Isle of Wight, 1; Chagford, Devonshire, 2; Combmartin, Devonshire, 1; South Molton, Devonshire, 1; Lundy Island, Devonshire, 1; Isle of Man, 8.

IRELAND: Clonbroch, Co. Galway, 1; Caragh Lake, Co. Kerry, 1; Co. Longford, 1; Knock, Co. Down, 1; North Esk, Dunkettle, 2; Duncannon, 3; Kilkenny, 1; no exact locality, 2.

NORWAY: Holaaker, upper Gudbrandsdal, 1; Graven, Hardanger, 1 (U.S.N.M.).

SWEDEN: Upsala, 1 (U.S.N.M.); near Stockholm, 1; Svarta, Orebro, 1 (U.S.N.M.).

FRANCE: Barbizon, Seine-et-Marne, 1; Montréjeau, Haute-Garonne, 1 (U.S.N.M.); Ax-les-Thermes, Ariège, 2; l'Hospitalet, Ariège, 3; Porté, Pyrénées-Orientales, 1.

GERMANY: Brunswick, 3 (B.M. and U.S.N.M.); Bodethal, Harz Mts., 3 (U.S.N.M.); Mäuseklippe, Bodethal, Harz Mts., 1 (U.S.N.M.); Frankfort-on-Main, Hessen-Nassau, 1; Niesky, Silesia, 1; Marxheim, near Mannheim, Bavaria, 2; near Königsberg, 2 (U.S.N.M.).

AUSTRIA-HUNGARY: Csallókőz-Somorja, Pressburg, Hungary, 1; Hatszeg, Hunyad, Transylvania, 7.

SWITZERLAND: St. Cergues, Vaud, 2 (U.S.N.M.); Stalden, Valais, 4 (Geneva); Untervatz, Grisons, 5 (U.S.N.M. and Mottaz); St. Gothard, Uri, 1.

ITALY: Vallombrosa, near Florence, 1.

1.	Lossiemouth, Morayshire, Scotland.	G. Denson (C & P).	8. 9. 17. 1.
♀, 1.	Lhanbryde, Elgin, 200 ft.	W. Taylor (C & P).	8. 9. 3. 1-2.
♀.	Dunblane, Stirlingshire.	W. R. Ogilvie-Grant (C & P).	8. 9. 6. 1.
1.	Aberdeen.	Dr. Macgillivray (C & P).	52. 7. 10. 13.
♂.	Dunvegan, Skye.	J. S. Elliott (C & P).	8. 9. 4. 1.
♂.	Stornoway, Lewis.	R. M. D. Hawker (C & P).	8. 9. 18. 1.
1 al.	North Uist, Hebrides.	J. A. Harvie Brown (C & P).	79. 9. 18. 1.
1.	Barra Island, Hebrides.	W. E. de Winton (C & P).	8. 9. 20. 1.

♂.	Stockbriggs, Lanarkshire.	E. R. Alston (C & P).	79. 9. 25. 13.
1.	Bridgend, Glamorganshire, Wales.	R. I. Pocock (C & P).	8. 9. 5. 1.
1 al.	Wales.	G. Stokes (C & P).	48. 9. 24. 3.
♀.	Grimsby, Lincolnshire, England.	G. H. Caton Haigh (C & P).	8. 9. 16. 1.
2.	Waltham, Lincolnshire.	G. H. Caton Haigh (C & P).	11. 1. 2. 81–82.
2 st.	Graftonbury, Herefordshire.	W. de Winton (C & P).	96. 4. 28. 20–21.
♀.	Wilbraham, Cambridgeshire. (*S. F. Harmer.*)	Miller Collection.	7. 7. 7. 2850.
1.	Clifton, Gloucestershire. (*R. I. Pocock.*)	Miller Collection.	7. 7. 7. 3604.
♂.	Lundy Island, Devonshire.	N. H. Joy (C & P).	6. 5. 16. 1.
2 ♂.	Chagford, Devonshire, 856 ft. (*W. P. Stark.*)	Miller Collection.	7. 7. 7. 4472, 4474.
♂, 4 ♀.	Ramsay, Isle of Man.	C. H. B. Grant (C & P).	8. 9. 7. 1–5.
♂.	Sulby Glen, Isle of Man.	C. H. B. Grant (C & P).	8. 9. 8. 4.
♀.	Clonbroch, Galway, Ireland.	H. F. Witherby (C & P).	8. 9. 19. 1.
1 al.	Longford.	Dr. G. E. Dobson (C & P).	80. 12. 14. 6.
♂ st.	Knock, Down.	Hon. N. C. Rothschild (C & P).	1. 9. 3. 7.
2 al.	Dunkettle, Cork.	Miss O'Keefe (C & P).	80. 11. 20. 4. 81. 6. 29. 1.
2 ♂, 1 ♀.	Duncannon, Wexford. (*Rev. Dr. Martin.*)	G. Barrett-Hamilton (P).	11. 1. 2. 83–85.
1 al.	Ireland.	Zoological Society's Collection.	52. 9. 13. 288.
♂.	Holaaker, Gudbrandsdal, 1900 ft. Norway.	R. J. Cuninghame (C & P).	98. 2. 28. 5.
♀.	Barbizon, Seine-et-Marne, France.	G. S. Miller (C).	8. 8. 4. 160.
2 ♀.	Ax-les-Thermes, Ariège.	V. Builles (C & P).	8. 3. 27. 2–3.
♂.	l'Hospitalet, Ariège, 4700 m.	G. S. Miller (C).	8. 8. 4. 159.
♂.	l'Hospitalet, Ariège, 1450 m. (*A. Robert.*)	O. Thomas (P).	8. 9. 1. 45.
♀.	Porté, Pyrénées-Orientales, 1600 m.	G. S. Miller (C).	8. 8. 4. 161.
2.	Querum Forest, Brunswick, Germany.	G. Barrett-Hamilton (P).	11. 1. 2. 86–87.
1 al.	Frankfort - on - Main, Nassau.	Tomes Collection.	7. 1. 1. 46.
♀.	Niesky, Silesia, 181 m. (*W. Baer.*)	Lord Lilford (P).	99. 1. 9. 15.
♂.	Marxheim, Bavaria.	Lord Lilford (P).	11. 1. 1. 146.
1.	Csallókőz-Somorja, Pressburg, 400 ft. Hungary.	Budapest Museum (E).	94. 3. 1. 25.
1.	Hatszeg, Hunyad, Transylvania, 2000–5500 ft.	C. G. Danford (C).	3. 2. 2. 11.
3.	Hatszeg, Transylvania, 2000–5500 ft.	C. G. Danford (C).	3. 2. 2. 13–15.
3 ♂.	Hatszeg, Hunyad, 1500–2000 ft.	C. G. Danford (C).	3. 11. 8. 16–18.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case (median).	Mandible.	Maxillary tooth-row (entire).	Mandibular tooth-row (entire).	Observations.
S. minutus minutus.											
Norway: Holaaker	98.2.28.5	♂	15·4	4·0	2·8	7·0	3·6	7·6	6·6	6·0	Teeth slightly worn.
Sweden: Upsala	84.910	♀	15·2	4·2	3·0	7·6	4·2	7·6	6·4	6·0	,, not worn.
Great Britain: Lhanbryde, Elgin		♀	15·8	4·0	2·6	7·4	4·2	8·0	6·6	6·0	,, ,,
Black Isle, Cromarty	8.9.20.1		16·0	4·2	2·8	7·4	4·2	8·0	6·6	6·2	,, ,,
Gordonstown, Elgin	152437	♀	15·4	4·0	3·0	7·6	4·0	8·0	6·2	6·0	,, ,,
Lossiemouth, Elgin	8.9.17.1		15·2	4·0	2·8	7·4	4·0	7·6	6·4	6·0	,, ,,
,, ,,	152438		15·2	4·0	3·0	7·4	4·2	7·8	6·6	6·2	,, ,,
Skye	8.9.4.1	♂	15·0	4·0	3·0	7·4	4·0	7·6	6·2	6·0	,, slightly worn.
Lundy Island, Devonshire	6.5.6.1		15·2	4·2	3·0	7·4	4·0	7·8	6·6	6·2	,, ,,
Chagford	7.7.7.4474	♂	15·8	4·2	3·0	7·8	4·0	8·0	6·6	6·2	,, ,,
New Forest, Hampshire	152446	♂	15·0	4·0	3·0	7·4	4·0	8·0	6·4	5·8	,, ,,
Glamorganshire	8.9.5.1	♀	16·0	4·2	3·0	7·6	4·0	8·0	6·6	6·2	,, not worn.
Isle of Man	8.9.7.4		15·4	4·2	2·8	7·2	3·6	7·8	6·4	6·0	,, slightly worn.
,, ,,			15·2	4·2	3·0	7·2	3·8	8·0	6·4	6·2	,, ,,
,, ,,	152448	♀	15·6	4·2	2·8	7·2	4·0	8·0	6·6	6·2	,, ,,

Ireland: Clonbroch	8.9.19.1	♀	15·4	4·2	3·0	7·2	4·2	7·8	6·4	6·0	Teeth slightly worn.
France: l'Hospitalet, Ariège . .	172106	♂	16·4	4·2	2·8	7·6	4·4	8·0	7·0	6·4	,, not worn.
,, ,, . .	8.8.4.159	♀	16·4	4·2	3·0	7·6	4·2	8·0	7·0	6·4	,, ,,
Porté, Pyrénées-Orientales .	8.8.4.161	♀	16·2	4·2	3·0	8·0	4·4	8·0	7·0	6·6	,, ,,
Ax-les-Thermes Ariège .	8.3.27.2	♀	16·6	4·2	3·2	7·2	3·8	8·0	7·0	6·4	,, slightly worn.
,, ,, .	8.3.27.3	♀	16·4	4·2	3·0	7·4	4·2	8·0	7·0	6·4	,, ,,
Germany: Niesky, Silesia. . .	99.1.9.15		15·6	4·2	2·8	7·2	3·8	8·0	6·6	6·2	,, ,,
Lochstedt, near Königsberg	112267	♀	14·8	4·0	2·6	7·0	4·0	7·8	6·2	6·0	,, ,,
,, ,, ,,	112270	♀	14·6	4·0	2·6	7·0	4·0	7·4	6·2	5·8	,, ,,
Brunswick . . .	85382		14·4	4·2	2·8	7·2	4·4	7·2	6·2	5·8	,, not worn.
Austria-Hungary: Hatszeg, Hunyad .	3.2.2.13		15·0	4·0	2·8	7·6	4·0	8·0	6·8	6·0	,, ,,
,, ,, .	3.2.2.14		15·8	4·2	3·0	7·6	3·8	8·0	7·0	6·2	,, slightly worn.
,, ,, .	3.2.2.16		15·6	4·0	3·0	7·6	4·0	7·8	6·4	6·0	,, not worn.
,, ,, .	3.2.2.17		16·0	4·2	3·0	8·0±	—	7·8	7·0	6·4	,, ,,
Switzerland: St. Cergues, Vaud. .	124448	♂	15·8	4·2	3·0	7·8	4·0	8·0	6·8	6·0	,, moderately worn.
Untervatz, Grisons .	123560	♂	15·2	4·0	2·8	7·4	4·0	7·8	6·6	6·0	,, slightly worn.
,, ,, .	115179	♀	15·2	4·4	3·0	7·4	3·8	8·2	6·8	6·2	,, ,,
,, ,, .	123564		16·2	4·4	3·0	7·4	3·8	8·2	—	6·2	,, ,,
,, ,, .	123565		15·0	4·2	2·8	7·4	3·6	7·6	6·6	6·2	,, ,,
Italy: Vallombrosa	1.8.2.4		16·0	4·2	3·0	7·8	4·0	7·8	6·8	6·2	,, not worn.
S. minutus lucanius.											
Italy: Monte Sirino	8.9.1.5		16·0	4·2	3·0	7·6	4·2	8·0	7·0	6·4	,, ,,

1.	St. Gothard, Uri, Switzerland.	Purchased (Brandt).	46. 2. 13. 14.
1 al.	Vallombrosa, Florence, Italy.	Dr. G. Cecconi (P.)	1. 8. 2. 4.

SOREX MINUTUS LUCANIUS Miller.

1909. *Sorex minutus lucanius* Miller, Ann. and Mag. Nat. Hist., 8th ser., III, p. 417, May, 1909. Type in British Museum.
1910. *Sorex minutus lucanius* Trouessart, Faune Mamm. d'Europe, p. 55.

Type locality.—Monte Sirino, Lagonegro, Italy.

Geographical distribution.—At present known from the type locality only.

Diagnosis.—Similar to *Sorex minutus minutus*, but with molars and anterior upper incisor noticeably enlarged

Teeth.—As compared with specimens of *Sorex minutus minutus* from a wide range of European localities and also with specimens from Scalipa and Sumela, Asia Minor, the type of *S. minutus lucanius* is at once recognizable by its enlarged teeth The actual size is so small that it is impossible to express the differences by measurements, but to the eye the greater area of the molar crowns and the larger more projecting anterior upper incisor and more robust unicuspids and anterior lower incisor are at once apparent.

Measurements.—Tail, 42; hind foot, 10·4. For cranial measurements see Table, p. 59.

Specimen examined.—The type.

1.	Monte Sirino, Lagonegro, S. Italy. (*A. Robert.*)	O. Thomas (P.) (*Type* of subspecies.)	8. 9. 1. 5.

SOREX ALPINUS Schinz.

(Synonymy under subspecies.)

Geographical distribution.—Pyrenees, Alps, Harz Mountains, Riesengebirge and Carpathians.

Diagnosis.—Size essentially as in *Sorex araneus* (head and body usually 65 to 70 mm.), but tail about equal to head and body; colour uniform dark slaty grey, the underparts nearly as dark as back; basal lobe of anterior upper incisor subterete, the length of its base about half that of anterior lobe.

External characters.—Except for the dark, slaty colour, and the much greater relative and actual length of the tail, *Sorex alpinus* does not differ markedly from *Sorex araneus* in general external characters. The fur of the back varies from 5 mm. to 8 mm. in depth according to season, and the tail may either be well covered with closely appressed hairs and provided with a pencil 4 to 5 mm. long, or practically naked at tip and very

scantily haired elsewhere, a variation not wholly dependent on season.* At middle of tail there are about 18 annulations to the centimeter. Feet relatively larger than in *Sorex araneus*, but not peculiar in form.

Colour.—Entire upper parts a deep slaty grey produced by the combination of blackish-slate under colour and short seal-brown tips, lightened to a varying degree by silvery sub-terminal annulations. Underparts slightly washed with sepia, but the difference in colour of the two surfaces not conspicuous, and sides entirely without line of demarcation. Feet scantily clothed with silvery hairs. Tail sharply bicolor, nearly black above and at tip, buffy whitish below, the light area always less extensive than the dark, and sometimes reduced on distal half of tail to a narrow median line.

Skull.—The skull, though of the same general dimensions as that of *Sorex araneus*, is recognizable by its less elevated brain-case, the outline of which when viewed from above is more nearly circular, owing to the very slight flattening of antero-external portion of border. Inter-orbital region less tapering than in the related species, a character due to the slightly though appreciably greater lachrymal breadth. The diameter of the tympanic ring is usually though not constantly less than in *Sorex araneus*. Anteorbital foramen slightly larger than in *S. araneus*. Lachrymal foramen opening over point of contact between first and second molars.

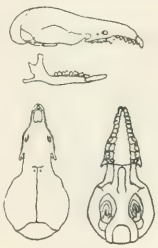

FIG. 12.
Sorex alpinus.
Nat. size.

Teeth.—Relatively to size of skull the teeth are noticeably smaller than in *Sorex araneus;* this is particularly evident in the anterior upper incisor when viewed from the side, and the upper unicuspids when viewed from below. Anterior upper incisor with basal lobe even smaller than in *S. minutus*, its height slightly less than that of first unicuspid and much less than that of anterior lobe of incisor. Viewed from below it appears to occupy decidedly less than half of tooth, while from side it appears scarcely half as large as first unicuspid, from which it further differs in its simple peg-like form. The two teeth come in contact at about the same level as in *S. araneus*, but their tips diverge more noticeably. Anterior lower incisor with shaft distinctly tapering, its cutting edge with three low, sometimes ill-defined lobes. Upper unicuspids less robust than in *Sorex araneus*, their crowns distinctly longer than broad. The cusp occupies more than half area of crown, at expense of crushing area, most of which, except in fifth unicuspid, lies obliquely instead of horizontally. Viewed from the side the unicuspids

* A specimen in full winter coat, but with the tail bare at tip (B.M. 3. 2. 2. 2), was taken at Hatszeg, Hunyad, Hungary, on December 12.

are all longer in proportion to their height than in *Sorex araneus*, and the posterior border is more concave. In size there is a gradual and regular diminution from first unicuspid to third; fourth somewhat more abruptly smaller;* fifth slightly smaller than fourth when viewed from the side, but with larger crown area due to the presence of a well developed postero-internal crushing surface. This tooth is relatively larger and more functional than in *Sorex araneus*, showing no tendency to become subordinate to paracone of large premolar. Lower unicuspids narrower and more trenchant than in *Sorex araneus*. Except for this general tendency the second shows no special peculiarities of form. The first, however, is strikingly different from the corresponding tooth in *S. araneus*. Its general outline when viewed from side is irregularly elliptical, with longest axis parallel to that of mandible, the upper edge with two low, rounded cusps, the anterior of which is about as large as lobes on cutting edge of incisor, the posterior smaller. Upper cheek-teeth not essentially different from those of *Sorex araneus*, except that hypocones are less developed. Lower cheek-teeth as in the related species. Pigmentation of teeth slightly less extensive than usual in *Sorex araneus*.

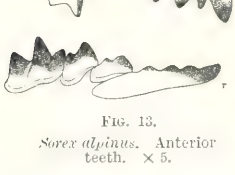

FIG. 13.
Sorex alpinus. Anterior teeth. × 5.

SOREX ALPINUS ALPINUS Schinz.

1837. *Sorex alpinus* Schinz, Neue Denkschr. Allgem. Schweiz. Gesellsch. Naturwiss., Neuchatel, I, p. 13 (St. Gothard Pass, Switzerland).

1840. ? *Sorex antinorii* Bonaparte, Iconogr. Faun. Ital., I, fasc. 29 (No exact locality, and probably not a European species).

1857. *Sorex alpinus* Blasius, Säugethiere Deutschlands, p. 126.

1870. ? *Sorex intermedius* Cornalia, Catal. Descrit. Mamm. Ital., p. 27 (Hills of Brianza, Como, Italy). Part: body; see Sordelli, Atti Soc. Ital. Sci. Nat. e del Mus. Civ. Stor. Nat., Milano, XXXVIII, p. 364, 1899.

1899. ? *Sorex alpinus* var. *longobarda* Sordelli, Atti Soc. Ital. Sci. Nat. e del Mus. Civ. Stor. Nat., Milano, XXXVIII, p. 363 (MS. synonym of *intermedius*).

1910. *Sorex alpinus* Trouessart, Faune Mamm. d'Europe, p. 50.

Type locality.—St. Gothard Pass, Uri, Switzerland.

Geographical distribution.—From the Jura and Alps through Tirol to Transylvania; Pyrenees.†

* In an adult female from Brünig, Switzerland (No. 85830, U.S.N.M.), the third and fourth unicuspids on right side are fused into a single 2-cusped tooth, while those on left side are normal.

† I have seen no Pyrenean specimens of *Sorex alpinus*. For record of its occurrence see Trutat, Bull. Soc. Hist. Nat., Toulouse, XII, p. 100, 1878 ("massif de la Maladetta"). The animal is probably less common in the Pyrenees than in the Alps, as I was unable to find it in several localities resembling those where it regularly occurs in Switzerland.

Diagnosis.—Skull and teeth of maximum size for the species (condylobasal length of skull, 19·4 to 20·6; upper tooth-row, 8·6 to 9·0; lower tooth-row, 8·0 to 8·4).

Measurements.—Average and extremes of five specimens from Brünig, Switzerland: head and body, 74·6 (72–77); tail, 73 (70–75); hind foot, 16. Average and extremes of three specimens from Vitznau, Switzerland: head and body, 72·3 (69–75); tail, 74·0 (72–75); hind foot, 15·5 (15–16). Adult male from Vitznau, Switzerland: head and body, 69; tail, 68; hind foot, 15·3. Adult female from Chamonix, Haute-Savoie, France: head and body, 73; tail, 74; hind foot, 15·4. For cranial measurements see Table, p. 64.

Specimens examined.—Thirty-one, from the following localities:—

France: Chamonix, Haute-Savoie, 1 (U.S.N.M.).

Switzerland: St. Cergues, Vaud (Jura), 4 (U.S.N.M. and Mottaz); Brünig, 5 (U.S.N.M.); Vitznau, 4 (B.M. and U.S.N.M.); Andermatt, 1 (U.S.N.M.); St. Gothard, Uri, 6 (B.M. and U.S.N.M.); Untervatz, Grisons, 1 (U.S.N.M.); Murgthal, St. Gallen, 1 (U.S.N.M.); Säntis, St. Gallen, 1 (Mottaz); no exact locality, 3.

Austria-Hungary: Hatszeg, Hunyad, Transylvania, 4.

♂.	Vitznau, 440 m. Switzerland.	O. Thomas (c & p).	5. 8. 3. 15.
1.	St. Gothard, Uri.	Baron E. de Sélys-Longchamps (p).	45. 7. 5. 1.
1, 1 al.	St. Gothard, Uri.	Purchased (Brandt).	46. 2. 13. 13. 46. 2. 13. 14.
1.	St. Gothard, Uri.	Purchased (Stockholm Museum).	46. 6. 2. 32.
1.	Switzerland.	E. R. Alston (p).	79. 9. 25. 9.
1.	Switzerland.	Purchased (Gerrard).	76. 9. 18. 13.
♀.	Hatszeg, Hunyad, Transylvania, 2000 ft. Hungary.	C. G. Danford (c).	3. 2. 2. 2.
♂, 2 ♀.	Hatszeg, Hunyad, Transylvania, 1500–2000 ft.	C. G. Danford (c).	3. 11. 8. 12–14.

Sorex alpinus hercynicus Miller.

1909. *Sorex alpinus hercynicus* Miller, Ann. and Mag. Nat. Hist., 8th ser., iii, p. 417, May, 1909. Type in U.S. National Museum.

1910. *Sorex alpinus hercynicus* Trouessart, Faune Mamm. d'Europe, p. 51.

Type locality.—Mäuseklippe, Bode Valley, Harz Mountains, Germany.

Geographical distribution.—Harz Mountains and Riesengebirge.

Diagnosis.—Skull and teeth not so large as in typical *Sorex alpinus* (condylobasal length of skull, 19 to 19·6 mm.; upper tooth-row, 8·2 to 8·6 mm.; lower tooth-row, 7·8 to 8·0 mm.).

Measurements.—External measurements of type: head and body, 71, tail, 67; hind foot, 15·4. Average and extremes of six specimens from the Harz Mountains: head and body, 73·4

CRANIAL MEASUREMENTS OF *SOREX ALPINUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case (median).	Mandible.	Maxillary tooth-row (entire).	Mandibular tooth-row (entire).	Observations.
S. alpinus alpinus.											
France: Chamonix . . .	124505	♀	20·0	5·6	4·0	9·8	5·2	10·4	8·8	8·0	Teeth slightly worn.
Switzerland: St. Cergues, Vaud .	124451	♀	20·4	5·8	4·2	9·6	5·4	11·0	9·0	8·4	,, not worn.
,, ,, .	124452	♀	20·2	5·6	4·0	10·0	5·4	11·0	9·0	8·4	,, ,,
Vitznau . . .	124559	♀	20·0	5·4	4·2	10·0	5·2	10·4	8·8	8·2	,, ,,
,, . .	124560	♀	20·2	5·6	4·2	9·8	5·2	10·8	8·8	8·2	,, slightly worn.
,, . .	124561	♀	20·0	5·6	4·2	10·0	5·6	10·6	8·8	8·2	,, not worn.
Brünig . . .	85827	♀	20·4	5·6	4·1	9·8	5·4	10·4	9·0	8·2	,, ,,
,, . . .	85828	♀	20·6	5·6	4·2	10·0	5·4	11·0	9·0	8·4	,, ,,
,, . . .	85829	♀	20·0	5·6	4·2	10·0	5·2	10·8	8·8	8·2	,, ,,
,, . . .	85830	♀	19·4	5·6	4·2	9·2	5·6	10·4	8·6	8·0	,, slightly worn.
,, . . .	85831	♀	20·0	5·6	4·2	9·8	5·4	11·0	8·8	8·2	,, not worn.
Andermatt . .	85826	♀	19·4	5·4	4·0	9·6	5·2	10·2	8·6	8·0	,, ,,
S. alpinus hercynicus.											
Germany: Wolfshau, Silesia . .	112925	♀	19·2	5·2	4·0	9·4	5·4	10·0	8·4	8·0	,, ,,
,, ,, . .	112926	♀	19·4	5·0	4·0	9·0	5·4	9·8	8·2	7·8	,, ,,
Eulengrund . . .	112930	♀	19·2	5·2	4·0	9·8	5·2	10·0	8·4	8·0	,, ,,
,, . . .	112932	♀	19·4	5·2	4·0	9·8	5·2	10·0	8·6	8·0	,, ,,
Bahrenberg, Harz Mts. .	112924	♂	19·6	5·4	4·0	9·8	5·0	10·0	8·4	8·0	,, slightly worn.
Mäuseklippe ,, .	112927	♂	19·6	5·2	4·0	9·8	5·0	10·4	8·4	8·0	,, ,,
,, ,, .	112928*	♂	19·2	5·2	4·0	9·8	5·2	10·0	8·4	7·8	,, not worn.
,, ,, .	112929	♂	19·6	5·2	4·0	9·4	5·0	10·0	8·6	8·0	,, slightly worn.

* Type.

(72–77); tail, 66·6 (65–68); hind foot, 15·1 (14·8–15·8). Average and extremes of five specimens from the Riesengebirge: head and body, 73·4 (72–77); tail, 65·4 (59·68); hind foot, 14·9 (14·8–15·0). For cranial measurements see Table, p. 64.

Specimens examined.—Eleven (all in U.S.N.M.), from the following localities in Germany: Bahrenberg, Harz Mts., 2; Bodethal, Harz Mts., 1; Mäuseklippe, Harz Mts., 3; Eulengrund, Riesengebirge, Silesia, 3; Wolfshau, Riesengebirge, Silesia, 2.

Remarks.—In external measurements the Alpine shrew of the Harz Mountains and Riesengebirge agrees with the Swiss animal; but the differences in length of skull and of tooth-rows seem enough to warrant the recognition of the two forms as distinct.

Genus **NEOMYS** Kaup.

1829. *Neomys* Kaup, Entw.-Gesch. u. Natürl. Syst. Europ. Thierwelt, I, p. 117 (*Sorex daubentonii* Erxleben).

1829. *Leucorhynchus* Kaup, Entw.-Gesch. u. Natürl. Syst. Europ. Thierwelt, I, p. 117 (*Sorex lineatus* Geoffroy and *S. leucodon* Hermann; the first chosen as type by Thomas, The Zoologist, 4th ser., II, p. 102, March, 1898).

1829. *Hydrogale* Kaup, Entw.-Gesch. u. Natürl. Syst. Europ. Thierwelt, I, p. 119 (*Sorex remifer* Geoffroy).

1832. *Crossopus* Wagler, Isis, p. 275 (*Sorex fodiens* Schreber).

1835. *Hydrosorex* Duvernoy, Mém. Soc. du Mus. d'Hist. Nat., Strasbourg, II, p. 19 (*Sorex fodiens* Pallas, see p. 17).

1835. *Amphisorex* Duvernoy, Mém. Soc. du Mus. d'Hist. Nat., Strasbourg, II, p. 23 (*hermanni* = *fodiens* skull + *Sorex araneus tetragonurus* animal). Part.

1838. *Pinalia* Gray, Proc. Zool. Soc., London (1837), p. 126, June 14, 1838 (MS. synonym of *Crossopus*).

1848. *Galemys* Pomel, Archiv Sci. Phys. et Nat., Genève, IX, p. 249, November, 1848 (part, included *Brachysorex* Duvernoy, *Crossopus* Wagler, and *Pachyura* de Sélys-Longchamps).

1854. *Myosictis* Pomel, Catal. Méth. Vert. Foss. Bassin de la Loire, p. 14 (based on a fossil not distinguished specifically from *Neomys fodiens*).

1857. *Crossopus* Blasius, Säugethiere Deutschlands, p. 119.

1898. *Neomys* Thomas, Zoologist, 4th ser., II, p. 100, March 15, 1898.

Type species. *Sorex daubentonii* Erxleben = *S. fodiens* Schreber.

Geographical distribution.—Palæarctic region north of the Mediterranean from Spain and England to the Caucasus and Asia Minor, north to northern Scandinavia.

Characters.—Upper unicuspid teeth 4–4, their form more prehensory than in *Sorex;* dental formula: $i\frac{3-3}{1-1}$, $c\frac{1-1}{1-1}$, $pm\frac{2-2}{1-1}$, $m\frac{3-3}{3-3}=30$; posterior lobe of anterior upper incisor less than half as high as first; anterior lower incisor with one ill-defined lobe on cutting edge near middle of tooth; third lower molar and second lower unicuspid as in *Sorex;* points of all the teeth pigmented; fur unusually soft and dense, entirely concealing ears; feet with a noticeable fringe of elongated hairs at edges of soles and toes,

the hind feet enlarged and turned somewhat outward; in one species a longitudinal ridge of stiffened hairs along under surface of tail; ear small, completely hidden in the fur, the meatus closed by two valves, one of which lies on inner surface of antitragus, the other on inner surface of conch; habits aquatic.

Remarks.—In its external form, slight reduction in the number of teeth, and in the noticeably prehensory adaptation of the upper incisors and unicuspids, the members of the genus *Neomys* are distinctly more specialized than the species of *Sorex*. They retain, however, the primitive form of the third lower molar and lower premolar characteristic of *Sorex*, these teeth showing no tendency to the more highly modified structure found in *Crocidura*. The members of the genus *Neomys* are the only European shrews specially adapted to aquatic life. They are at once recognizable by their dense, velvety fur, and large, distinctly fringed hind feet. In the commonest and most widely distributed species the tail is provided with a keel of stiffened hairs, a character not found in any other European shrew.

KEY TO THE EUROPEAN FORMS OF *NEOMYS*.

Tail with median keel of stiffened hairs extending entire length of under surface ..... *N. fodiens*, p. 66.
Underparts whitish or yellowish, occasionally brownish (Continental Europe except Iberian Peninsula) ..... *N. f. fodiens*, p. 69.
Underparts usually brownish (England and Scotland) ..... *N. f. bicolor*, p. 73.
Tail without keel.
Length of tail 47 to 53 mm.; hind foot 16 to 17 mm. (Alps and Pyrenees) ..... *N. milleri*, p. 78.
Length of tail 55 to 61 mm.; hind foot 16·8 to 18 mm. (Northern and central Spain) ..... *N. anomalus*, p. 81.

NEOMYS FODIENS Schreber.

(Synonymy under subspecies.)

Geographical distribution.—From Norway and England to the Pyrenees, northern Italy and western Siberia. Northern and eastern limits of range not known.

Diagnosis.—Tail with keel always present; feet very conspicuously fringed; hind foot usually more than 17 mm.; lachrymal foramen opening over posterior half of m^1; anterior upper incisor robust.

External characters.—Fur very dense, its depth at middle of back about 6 mm. in summer, 9 mm. in winter, its texture soft and velvety, this particularly noticeable on underparts; a few longer hairs usually present on flanks and rump. Eyes small and inconspicuous; ears completely hidden by the fur. Muzzle less slender than in *Sorex araneus*, the median ridge on upper lip with distinct wart-like outgrowth which fits between points of upper incisors when mouth is closed. Feet larger than

in species of *Sorex* of approximately the same size, noticeably broadened; digits proportioned as in *Sorex araneus* but graduation less; soles and palms completely bare, their surface strongly tuberculo-reticulate; pads 6–6, much as in *Sorex araneus* but more widely spaced and better defined. At edge of soles and toes the hairs are elongated to form a dense, conspicuous fringe. Tail terete or slightly four-sided, its hairs minute, flattened, and closely appressed, nearly concealing the rather indistinct annulations, of which there are about 25 to the centimeter at middle; pencil evident, usually about 3 to 5 mm. in length. Along median line of tail below, from extreme base to tip, the hairs are so crowded, elongated, and directed inward as to form a distinct, low keel, the presence of which is often made more evident by the nearly bare condition of the skin immediately at each side of it. Mammæ: *a* 2–2, *i* 2–2 = 8.

Colour.—Entire underparts a dark slaty grey, more bluish in summer, more blackish in winter, the individual hairs blackish-slate with seal-brown tips and a sub-terminal lighter area of varying distinctness. Underparts usually whitish in strong contrast with back, the line of demarcation everywhere evident, and on head passing just below base of ear and extending along upper lip to nostril. The underparts, while never so dark as back, are often strongly suffused with buffy, smoky, or wood-brown, and occasionally tinged with salmon-colour. A small whitish tuft usually springs from inner surface of ear, and a minute speck of the same colour is generally present behind eye. Feet thinly sprinkled with silvery grey hairs. Tail a dark indefinite brown above, slightly less dark below, the keel usually a silver grey, sometimes standing out in strong contrast against the dark surrounding parts.

Skull.—The skull differs from that of *Sorex araneus* in larger size, relatively larger, more inflated brain-case (depth decidedly more than half breadth), and lower, more flattened rostrum and interorbital region. The brain-case is sub-circular in outline, though distinctly flattened antero-externally and postero-externally; in front it is marked off from interorbital region by a conspicuous, well defined angle. In lateral view the profile of brain-case is high and rounded posteriorly, low anteriorly where it passes by a distinct, often conspicuously abrupt curve into the nearly flat dorsal outline of interorbital region and rostrum. Anteorbital foramen relatively larger and more widely open than in the European species of *Sorex*. Lachrymal foramen over posterior half of m^1. Mesopterygoid space decidedly more than half as wide as long; hamular processes shorter than in *Sorex araneus*

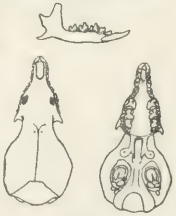

FIG. 14.
Neomys fodiens.
Nat. size.

and more abruptly turned outward. Foramen ovale appearing rather conspicuously in region between hamular and postglenoid process. Rudimentary zygomatic process of maxillary well developed, essentially as in *Sorex araneus*.

Teeth.—Though in general not strikingly different from those of *Sorex araneus* the teeth show a tendency towards greater elevation of the cusps as well as a more pronounced hooking forward of the anterior upper incisor, peculiarities which impart to the entire dentition, though particularly to the teeth lying in front of the large premolars, an unmistakably prehensive character. Anterior upper incisor with main hook more projecting than in *Sorex araneus;* posterior talon low though rather long, its outline when viewed from the side somewhat triangular, its height less than half that of main cusp and much less than that of first unicuspid. Lower incisor more slender than that of *Sorex araneus*, its cutting edge with only a single low, ill-defined lobe near middle. Upper unicuspids large and strong, their crowns when viewed from below decidedly longer than wide, truncate posteriorly, narrowed anteriorly and terminating in a slight though evident point. In lateral view the cusps appear to be more slender and set further forward than in *Sorex araneus*, and the posterior part of crown is more produced backward, the cingulum often rising to a distinct postero-internal angle or rudimentary cusp, particularly in first tooth. Spaces between tips of unicuspids greater than in the European species of *Sorex*. Each cusp is nearly terete, but with a small postero-internal concavity continuous with the concave crushing area which occupies postero-internal fourth of crown. The concave area of cusp and crown is bounded externally by a low but distinct ridge extending to middle of posterior border of crown. First and second unicuspids sub-equal; third about half as large as first or second though quite similar to them in form; fourth not half as large as third, in tooth-row or crowded somewhat inward, always distinctly visible from outer side, in contact posteriorly with large premolar. Lower unicuspids relatively longer and lower than in *Sorex araneus*, their form when viewed from the side much as in *Sorex alpinus*, except that the first has a very rudimentary posterior cusp. First somewhat more than half as large as second, its general outline much the same as in corresponding upper teeth. Second essentially as in *Sorex araneus*. Larger cheek-teeth as in *Sorex araneus*, but main cusps higher and hypocones better developed. Pigmentation of teeth about

FIG. 15.

Neomys fodiens. Anterior teeth in profile. × 5.

as in *Sorex araneus araneus*, the hypocones usually if not always white.*

Measurements.—In external measurements this species is unusually variable, the head and body ranging from 72 to 96 mm., tail from 47 to 77 mm., and hind foot from 16 to 20 mm. These differences appear to be for the most part strictly individual. The skull is more constant: condylobasal length, 19·6 to 22·2 mm.; upper tooth-row, 9·6 to 11 mm. Here the variation is to a certain extent geographic, as the skull of the British race averages smaller than that of the Continental form.

Remarks.—*Neomys fodiens* is the common and widely distributed water-shrew of Europe. It may always be recognized by its large size, fringed feet and keeled tail. While the keel varies greatly in depth and distinctness, some trace of it is always present on basal half of tail, the region in which the median hairs are never modified in the round-tailed members of the genus.

Neomys fodiens fodiens Schreber.

1776. *Sorex aquaticus* P. L. S. Müller, Natursyst. Suppl. u. Regist.-Band, p. 36 (France; based on Buffon, viii, pl. 11). Not *Sorex aquaticus* Linnæus, 1758.

1777. *Sorex fodiens* Schreber, Säugthiere, iii, p. 571 (Berlin, Germany).

1777. [*Sorex*] *daubentonii* Erxleben, Syst. Regni Anim., i, p. 124 (Burgundy, France; based primarily on the Musaraigne d'eau of Daubenton, Hist. de l'Acad. Roy. des Sci., Paris, 1756, p. 42).

1780. *Sorex carinatus* Hermann in Zimmermann, Geogr. Gesch., ii, p. 382 (Strassburg, Germany).

1792. *Sorex liricaudatus* Kerr, Anim. Kingd., p. 208 (Strassburg, Germany; based on Pennant's account of *Sorex carinatus* Hermann).

1793. [*Sorex*] *fluviatilis* Bechstein, Gemeinn. Naturgesch. Deutschlands, iii, p. 746 (Suggested but not adopted as preferable to *fodiens*).

1793. *Sorex eremita* Meyer, Zool. Annalen, i, p. 323 (Thüringen, Germany).

1793. *Sorex fluviatilis* Meyer, Zool. Annalen, i, p. 323 (Published as a synomym of *Sorex eremita*, perhaps from Bechstein MS.).

1800. *S*[*orex*] *f*[*odiens*] *albus* Bechstein, Thomas Pennant's Allgem. Uebers. vierfüss. Thiere, ii, p. 723.

1811. *Sorex hydrophilus* Pallas, Zoogr. Rosso-Asiat., p. 130 (Berlin, Germany).

1811. *Sorex lineatus* Geoffroy, Ann. Mus. d'Hist. Nat., Paris, xvii, p. 181 (Paris, France). Type in Paris Museum.

1811. *Sorex remifer* Geoffroy, Ann. Mus. d'Hist. Nat., Paris, xvii, p. 182 (Abbeville, Somme, France). Type in Paris Museum.

1818. *Sorex collaris* Desmarest, Nouv. Dict. d'Hist. Nat., xxii, p. 65 (Holland: islands at mouth of Escaut and Meuse). Described but not named by Geoffroy, Mém. Mus. d'Hist. Nat., Paris, i, p. 309, 1815.

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* In an adult male from Geneva, Switzerland (No. 1046 Mottaz), the right upper incisor and first unicuspid and right lower incisor are white throughout. All other teeth normal.

1822. *Sorex macrourus* Lehmann, Observ. Zoologicæ in faunam Hamburgensem, I, p. 5 (Sachsenwald, near Friedrichsruh, Schleswig-Holstein, Germany).

1826. *Sorex amphibius* Brehm, Ornis, II, p. 44 (Renthendorf, Thüringen, Germany).

1826. *Sorex natans* Brehm, Ornis, II, p. 44 (Renthendorf, Thüringen, Germany).

1826. *Sorex stagnatilis* Brehm, Ornis, II, p. 47 (Renthendorf, Thüringen, Germany).

1830. *Sorex rivalis* Brehm, Isis, p. 1128 (Renthendorf, Thüringen, Germany).

1832. *Sorex musculus* Wagler, Isis, p. 54 (Bavaria, Germany).

1832. *Sorex psilurus* Wagler, Isis, p. 54 (Bavaria, Germany).

1834. *S[orex] nigripes* Melchior, Den Danske Stats og Norges Pattedyr, p. 68 (Sielland, Denmark).

1835. *Sorex fodiens* Duvernoy, Mém. Soc. du Mus. d'Hist. Nat., Strasbourg, II, p. 17. Part: animal, *not* skull.

1835. *Sorex hermanni* Duvernoy, Mém. Soc. du Mus. d'Hist. Nat., Strasbourg, II, p. 23 (Strassburg, Germany). Part: skull, *not* animal.

1838. *Amphisorex linneana* Gray, Ann. Nat. Hist., II, p. 287, December, 1838 (North Bothnia, Sweden).

1839. [*Sorex fodiens*] var. *leucotis* de Sélys-Longchamps, Études de Micromamm., p. 142 (described on p. 25) (St. Gervais, at foot of Mt. Blanc, Haute-Savoie, France).

1839. ? [*Sorex fodiens*] var. *albiventris* de Sélys-Longchamps, Études de Micromamm., p. 142 (nomen nudum).

1845. ? [*Sorex fodiens*] var. *nigricans* Nilsson, Atti della sesta Riunione degli Scienziati Italiani, Torino, 1844, p. 357 (Sweden). Nomen nudum.

1857. *Crossopus fodiens* Blasius, Säugethiere Deutschlands, p. 120 (part).

1868. *Sorex fimbriatus* and *Crossopus fimbriatus* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LVII, pt. 1, p. 610 (Synonyms of "*Crossopus daubentonii nigripes*," wrongly attributed to Giebel, Säugethiere, p. 899). Not *Sorex fimbriatus* Wagler, 1832.

1868. *Crossopus ciliatus*, *griseogularis* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LVII, pt. 1, p. 623 (Chartres, Eure-et-Loire, France).

1870. *Sorex intermedius* Cornalia, Catal. Descrit. Mamm. Ital., p. 27 (Hills of Brianza, Como, Italy). Part: tail only (see Sordelli, Atti Soc. Ital. Sci. Nat. e del Mus. Civ. Stor. Nat., Milano, XXXVIII, p. 364, 1899).

1895. *Neomys fodiens* Thomas, The Zoologist, 4th ser., II, p. 100, March, 1908.

1899. *Sorex alpinus* var. *longobardus* Sordelli, Atti Soc. Ital. Sci. Nat. e del Mus. Civ. Stor. Nat., Milano, XXXVIII, p. 363 (MS. synonym of *intermedius*).

1901. *Neomys fodiens minor* Miller, Proc. Biol. Soc., Washington, XIV, p. 45, April 25, 1901 (Montréjeau, Haute-Garonne, France). Type in U.S. National Museum.

1905. *Crossopus* ou *Sorex ignotus* Fatio, Arch. Sci. Phys. et Nat., Genève, 4th ser., XIX, p. 202, February 15, 1905 (Switzerland). Part: skull, *not* mandible. Type in Geneva Museum.

1905. *Neomys fodiens naias* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., XV, p. 507, May, 1905 (Hatszeg, Hunyad, Hungary). Type in British Museum.

1906. *Neomys fodiens nanus* Lydekker, Zoological Record, XLII (1905), Mamm., p. 34, August, 1906 (Accidental renaming of *naias*).
1910. *Neomys fodiens, N. fodiens naias* and *N. fodiens minor* Trouessart, Faune Mamm. d'Europe, pp. 56, 57.

Type locality.—Berlin, Germany.

Geographical distribution.—Continental Europe from Norway to Italy and the Pyrenees.

Diagnosis.—Underparts buffy whitish, occasionally tinged with a stronger shade of yellow or suffused with salmon-colour, and sometimes though rarely washed with wood-brown, especially on chest and along median line of belly. Condylobasal length of skull usually more than 21 mm.

Measurements.—Average and extremes of ten specimens from Brunswick, Germany: head and body, 86·6 (83–92); tail, 65·5 (58–77); hind foot, 18·5 (17–19). Average of three specimens from Montréjeau, Haute-Garonne, France: * head and body, 83 (82–85); tail, 52 (50–60); hind foot, 17·1 (16–18). Average and extremes of seven specimens from Luchon, Haute-Garonne, France: head and body, 75·7 (72–80); tail, 53·1 (47–58); hind foot, 16·4 (16–17). Average and extremes of five specimens from Porté, Pyrénées-Orientales, France: head and body, 93 (83–96); tail, 61 (57–65); hind foot, 18·2 (18–19). Average and extremes of nine specimens from Meiringen, Bern, Switzerland: head and body, 82·7 (80–86); tail, 66·2 (62–71); hind foot, 19·3 (18–20). Average and extremes of ten specimens from Hatszeg, Hunyad, Transylvania: † head and body, 77·7 (72–82); tail, 60 (56–66); hind foot, 18·5 (18–19). For cranial measurements see Table, p. 75.

Specimens examined.—One hundred and thirty-four, from the following localities:—

NORWAY: Vefsen, Nordland, 1; Kvikne, Hedemarken, 1; Brekkebygden, Trondhjem, 1.

SWEDEN: Bothnia, 1; Upland, 1; Medstugan, Jemtland, 1; Upsala, 1 (U.S.N.M.); no exact locality, 1.

BELGIUM: Waremme, Liége, 3 (U.S.N.M.).

FRANCE: Guines, Pas-de-Calais, 2; Abbeville, Somme, 2 (B.M. and Paris; the latter type of *remifer* Geoffroy); near Paris, 1 (Paris; type of *lineatus* Geoffroy); Dinan, Côtes-du-Nord, 1; Cadillac-sur-Garonne, Gironde, 2 (U.S.N.M.); Montréjeau, Haute-Garonne, 3 (U.S.N.M.); Porté, Pyrénées-Orientales, 5; l'Hospitalet, Ariège, 2; Luchon, Haute-Garonne, 7; Barèges, Hautes-Pyrénées, 3; Barcelonnette, Basses-Alpes, 1; Chamonix, Haute-Savoie, 1 (U.S.N.M.); Cranves-Sales, Haute-Savoie, 1; Scientrier, Haute-Savoie, 1 (Mottaz); Étupes, Doubs, 6 (Mottaz); no exact locality, 1.

GERMANY: Brunswick, 10 (U.S.N.M.); Saxony, no exact locality, 1 (U.S.N.M.); Bahrenberg, Harz Mts., 1 (U.S.N.M.); Frankfort, Wiesbaden, 1; Niesky, Silesia, 1; Strassburg, 1.

AUSTRIA-HUNGARY: Haida, Arva, Bohemia, 3; Hatszeg, Hunyad, Transylvania, 11.

SWITZERLAND: Geneva, 4 (Mottaz); Chesières, Vaud, 4 (Mottaz); Les Plans, Vaud, 3 (U.S.N.M.); Meiringen, Bern, 9 (U.S.N.M.); Grindelwald,

* "*Neomys fodiens minor*" Miller.
† "*Neomys fodiens naias*" Barrett-Hamilton.

Bern, 1 (U.S.N.M.); Mürren, 2; Göschenen, Uri, 2 (U.S.N.M.); St. Gothard, Uri, 1 (U.S.N.M.); Züberwangen, St. Gallen, 8 (B.M. and U.S.N.M.); St. Fiden, St. Gallen, 2 (U.S.N.M.); Murgsee region, St. Gallen, 5 (U.S.N.M.); Au, St. Gallen, 1 (U.S.N.M.); Uzwil, St. Gallen, 1 (U.S.N.M.); Sitterwald, St. Gallen, 1 (U.S.N.M.); Faido, Ticino, 1; Gordola, Locarno, Ticino, 3; Porlezza, Ticino, 1 (Mottaz); Muzzano, Ticino, 1 (Mottaz); no exact locality, 1.

ITALY: Busalla, Liguria, 3; Vallombrosa, Florence, 1.

Remarks.—There is much individual variation in colour as well as in external measurements and proportions,* though the size of the skull and teeth, as may be seen from the Tables, remains very constant. The degree of development of the fringes on feet and keel on tail is also variable, the depth of the keel in some individuals being about equal to diameter of tail, while in others it is too slight to be measured. This is partly, if not entirely, due to season, as the deepest keels are found in winter specimens. With regard to the variations in external measurements shown by the averages and extremes in a preceding paragraph, it is probable that they are much exaggerated by different methods in taking the measurements. This is well illustrated by the two series of Pyrenean specimens measured by A. Robert at an interval of six years. While much material has been examined it is not wholly satisfactory, consisting chiefly of small lots taken by many different collectors. Eventually it may be necessary to recognize certain Continental forms such as *minor*, *naias*, and the Scandinavian *linneana*, as distinct from true *fodiens;* but for the present, in view of the uncertainties concerning external measurements and the striking similarity of skulls from the entire range of the animal, there seems to be no other alternative than to regard all the Continental water-shrews with keeled tail as belonging to a single race.

1.	Vefsen, Nordland, Norway.	E. G. B. Meade Waldo (C & P).	5. 7. 1. 1.
♂.	Kvikne, Hedemarken, 2200 ft. (*N. F. Ticehurst.*)	G. Barrett-Hamilton (P).	11. 1. 2. 88.
♀.	Brekkebygden, Trondhjem (*N. F. Ticehurst.*)	G. Barrett-Hamilton (P).	11. 1. 2. 89.
1.	Bothnia, Sweden.	Purchased. (Wahlberg.)	38. 9. 24. 14.
♀.	Medstugan, Jemtland, 550 m. (*G. Kolthoff.*)	Lord Lilford (P).	11. 1. 1. 147.
2 ♀.	Guines, Pas-de-Calais, France.	O. Thomas (C & P).	94. 6. 6. 1-2.
♂, 2 ♀.	Porté, Pyrénées-Orientales, 1600–1700 m. France. (*A. Robert.*)	O. Thomas (P).	8. 9. 1. 39-41.

* This tendency to variation, coupled with the animal's peculiarly attractive and interesting appearance, has led to the creation of the most formidable synonymy (33 distinct names) yet applied to a European mammal.

♂.	L'Hospitalet, Ariège, 1450 m. (*A. Robert.*)	O. Thomas (P).	8. 9. 1. 42.
♀.	L'Hospitalet, Ariège.	G. S. Miller (C).	8. 8. 4. 139.
♂, 2. 3 ♀.	Luchon, Haute-Garonne, 600–900 m. (*A. Robert.*)	O. Thomas (P).	6. 4. 1. 12. 14–18.
2 ♂.	Barèges, Hautes-Pyrénées, 1300–1500 m.	G. S. Miller (C).	8. 8. 4. 136–137.
♀.	Barcelonnette, Basses-Alpes. (*C. Mottaz.*)	O. Thomas (P).	8. 8. 10. 13.
1.	Cranves-Sales, Haute-Savoie.	A. Robert (P).	5. 4. 9. 2.
1.	Abbeville, Somme.	V. Baillon (C).	54. A.
1.	Frankfort, Wiesbaden, Germany.	Dr. Dieffenbach (P).	47. 1. 8. 46.
♀.	Niesky, Silesia, 181 m. (*W. Baer.*)	Lord Lilford (P).	99. 1. 9. 8.
1.	Strassburg, Alsace. (*C. Mottaz.*)	O. Thomas (P).	8. 8. 10. 12.
2 ♀.	Haida, Bohemia, Austria.	Lord Lilford (P).	11. 1. 1. 148–149.
1.	Hatszeg, Hunyad, Transylvania, 1500 ft. Hungary.	C. G. Danford (C).	3. 2. 2. 1.
6 ♂, 4 ♀.	Hatszeg, Transylvania, 1500–2000 ft.	C. G. Danford (C).	3. 11. 8. 2–11.
2.	Mürren, Bern, Switzerland.	W. Gurtner (P).	92. 10. 5. 1–2.
4 ♀.	Züberwangen, St. Gallen. (*E. Zollikofer.*)	O. Thomas (P).	4. 4. 5. 48–51.
♀.	Faido, Ticino.	O. Thomas (C & P).	5. 8. 2. 20.
3 ♂.	Locarno, Ticino.	O. Thomas (C & P).	5. 8. 2. 8–10.
1.	Switzerland.	Purchased (Parreys).	46. 6. 15. 61.
♂, 2 ♀.	Busalla, Liguria, Italy.	O. Thomas (C & P).	5. 8. 3. 16–18.
1 al.	Vallombrosa, Florence.	Dr. G. Cecconi (P).	1. 8. 2. 1.

Neomys fodiens bicolor Shaw.

1791. *Sorex bicolor* Shaw, Naturalists' Miscellany, II, pl. 55, named in index (Oxford, England).

1805. *Sorex ciliatus* Sowerby, British Miscellany, XLIX, p. 103 (Norfolk, England).

1837. *Amphisorex pennanti* Gray, Proc. Zool. Soc., London, p. 125 (England).

1840. *Crossopus sowerbyi* Bonaparte, Iconogr. Faun. Ital., I, fasc. 29, in text under *C. fodiens.*

1857. *Crossopus fodiens* Blasius, Säugethiere Deutschlands, p. 120 (part).

1905. *Neomys fodiens ciliatus* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., XV, p. 508, May, 1905.

1910. *Neomys fodiens ciliatus* Trouessart, Faune Mamm. d'Europe, p. 56.

Type locality.—Oxford, England.

Geographical distribution.—Great Britain.

Diagnosis.—Similar to *Neomys fodiens fodiens*, but underparts usually washed with wood-brown. Condylobasal length of skull usually less than 21 mm.

Measurements.—External measurements of two adult females from Scotland (Grantown-on-Spey and Cortachy, Forfar): head

and body, 83 and 71 ; tail, 57·5 and 53·5 ; hind foot, 18 and 17. Adult male from Wellington, Somerset : head and body, 75 ; tail, 48 ; hind foot, 17. Adult male from Yalding, Kent : head and body, 82 : tail, 52 ; hind foot, 17. For cranial measurements see Table, p. 77.

Specimens examined.—Forty-six, from the following localities :—

Scotland : Gordonstown, Elgin, 1 ; Dunphail, Elgin, 1 ; Grantown-on-Spey, Elgin, 1 (Wilson) ; Cortachy, Elgin, 1 (Wilson) ; Cromlix, Stirlingshire, 1 ; Knibruck, Stirlingshire, 1 ; Aberdeen, 1 ; Penkill, Ayrshire, 1.

Wales : Fishguard, Pembrokeshire, 1 ; no exact locality, 1.

England : Mill-on-Tyne, Northumberland, 1 ; Leeds, Yorkshire, 1 ; Wellington, Somerset, 1 ; Great Grimsby, Lincolnshire, 2 ; Shaftesbury, Dorset, 1 ; Halesworth, Suffolk, 1 ; Cambridgeshire, 2 ; Thornhaugh, Northampton, 1 ; Podington, Wellingborough, Northamptonshire, 1 ; Henley-on-Thames, Oxfordshire, 2 ; Drinkstone Park, Bury St. Edmunds, Suffolk, 1 ; Woolpit, Bury St. Edmunds, Suffolk, 3 ; Halesworth, Suffolk, 1 ; Cambridgeshire, 2 ; Epping, Essex, 1 : Banstead, Surrey, 3 ; Esher, Surrey, 1 ; Garratt Park Lake, Surrey, 1 ; Godalming, Surrey, 1 ; Tillingbourne Stream, Surrey, 1 ; New Forest, Hampshire, 4 ; Basingstoke, Hampshire, 2 ; Hampshire, no exact locality, 2 ; Yalding, Kent, 1.

♂.	Dunphail, Elgin.	Miller Collection.	7. 7. 7. 2848.
1 al. ♀	Aberdeen, Scotland.	Hon. N. C. Rothschild (P).	10. 11. 28. 1.
1.	Penkill, Ayrshire.	E. R. Alston (P).	79. 9. 25. 8.
♀.	Fishguard, Pembrokeshire, Wales.	Y. H. Mills (C & P).	11. 1. 3. 376.
1.	Wales.	S. Stokes (C & P).	48. 9. 24. 4.
♀.	Mill-on-Tyne, Northumberland, England.	Rev. H. H. Slater (C & P).	11. 1. 3. 375.
1 al.	Wellingborough, Northamptonshire.	R. R. Orlebar (C & P).	84. 4. 21. 1.
1.	Halesworth, Suffolk.	Rev. W. R. Tate (C & P).	87. 6. 7. 1.
♀.	Cambridgeshire.	J. Baker (C & P).	39. 9. 29. 26.
1.	Cambridgeshire. (*J. Baker.*)	E. R. Alston (P).	79. 9. 25. 7.
1.	Epping, Essex.	J. Baker (P).	40. 4. 11. 9.
2 al.	Henley, Oxfordshire.	W. Royal Dawson (C & P).	11. 1. 3. 377.
1 al.	Bury St. Edmunds, Suffolk.	J. H. Powell (C & P).	83. 8. 8. 1.
3 al.	Bury St. Edmunds, Suffolk.	Duncan Parker (P).	84. 5. 16. 1-3.
♂ al.	Esher, Surrey.	E. Dalgleish (C & P).	11. 1. 3. 378.
♀ al.	Godalming, Surrey.	W. T. Blanford (C & P).	94. 8. 5. 2.
♂, 3 ♀.	New Forest, Hampshire.	Miller Collection.	7. 7. 7. 2845-2849.
2 ♀.	Basingstoke, Hampshire.	Miller Collection.	7. 7. 7. 4470-4471.
2 al.	Hampshire.	E. Bartlett (P).	74. 11. 24. 1-2.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case (median).	Mandible.	Maxillary tooth-row (entire).	Mandibular tooth-row (entire).	Observations.
N. fodiens fodiens.											
Sweden: Upsala	84909	♂	20·0	6·4	5·0	10·2	6·2	11·2	10·0	9·4	Teeth slightly worn.
Medstugan, Jemtland	11. 1. 1. 147	♀	21·4	6·6	5·0	10·6	6·0	11·2	10·2	9·6	,, ,,
Belgium: Waremme, Liége	86004	♂	20·4	6·8	5·2	10·6	6·0	11·2	10·2	9·4	,, ,,
France: Guines, Pas-de-Calais	94. 6. 6. 1		21·4	7·2	5·4	11·0	6·0	12·0	10·2	9·4	,, ,,
,, ,,	94. 6. 6. 2		21·0	7·0	5·2	10·8	6±	11·6	10·2	9·6	,, ,,
Cadillac	86978	♀	21·6	7·4	5·2	10·8	6·0	12·2	10·6	9·8	,, moderately worn.
,,	86979	♀	21·8	7·2	5·0	10·6	6·0	12·0	10·8	10·0	,, not worn.
Montréjeau	101309	♂	20·6	6·8	4·8	10·2	5·6	11·4	10·2	9·6	,, slightly worn.
,,	101310	♂	21·2	7·2	4·8	10·2	5·8	12·0	10·4	9·4	,, ,,
,,	101311*	♂	20·2	6·8	4·8	10·2	5·6	10·8	10·2	9·2	,, ,,
L'Hospitalet, Ariège	8. 8. 4. 139	♀	21·4	6·6	5·0	10·6	5·8	12·0	10·8	10·0	,, not worn.
Porté, Pyrénées-Orientales	2421 Robert	♀	21·2	7·2	5·0	11·0	5·8	11·4	10·0	9+	,, much worn.
,, ,, ,,	2622 Robert	♀	21·8	7·0	5·0	11·0	5·8	12·0	10·2	9+	,, ,,
Barèges, Hautes-Pyrénées	8. 8. 4. 136	♂	21·6	7·0	5·0	10·8	6·0	12·0	10·8	10·0	,, not worn.
,, ,, ,,	7203	♂	21·8	7·0	5·0	11·0	6·0	12·0	10·6	9·8	,, ,,
,, ,, ,,	8. 8. 4. 137	♂	21·6	7·0	5·0	10·8	6·0	11·8	10·8	10·0	,, ,,
Luchon, Haute-Garonne	6. 4. 1. 11	♂	20·0	6·6	5·0	10·4	5·4	11·0	10·0	9·0	,, moderately worn.
,, ,, ,,	6. 4. 1. 12	♂	21·0	7·0	5·0	10·8	5·4	11·8	10·4	9·4	,, ,,
,, ,, ,,	6. 4. 1. 14	♀	21·2	7·2	5·6	10·8	5·4	12·0	10·6	9·8	,, slightly worn.
,, ,, ,,	6. 4. 1. 16	♀	21·2	7·0	5·0	10·6	5·2	11·4	10·0	9·2	,, ,,
,, ,, ,,	6. 4. 1. 17	♀	21·4	7·2	5·4	11·0	5·4	12·0	10·2	9·6	,, ,,
Cranves-Sales, Haute-Savoie	5. 4. 9. 2	♂	21·2	7·0	5·0	11·0	6·0	11·8	10·4	9·4	,, moderately worn.

* Type of *Neomys fodiens minor* Miller.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case (median).	Mandible.	Maxillary tooth-row (entire).	Mandibular toothrow (entire).	Observations.
France: Étupes, Doubs	803 Mottaz	♂	22·0	6·8	5·0	10·6	5·6	11·8	10·0	9·2	Teeth not worn.
,, ,,	818 ,,	♂	21·0	7·0	5·2	10·8	5·8	11·8	10·0	9·0	,, much worn.
,, ,,	858 ,,	♀	21·0	7·0	5·0	11·0	6·0	—	10·2	9·4	,, slightly worn.
Germany: Brunswick	85641	♀	21·6	7·2	5·2	11·4	6·0	12·0	10·6	9·8	,, ,,
,,	85643	♀	20·8	7·0	5·0	10·8	5·6	11·2	10·6	9·6	,, ,,
,,	85376	♀	21·0	7·0	5·2	10·8	6·0	11·4	10·4	9·6	,, ,,
,,	85378	♀	20·8	7·0	5·2	10·8	6·0	11·6	10·2	9·4	,, ,,
,,	85379	♀	20·2	7·2	5·0	10·2	6·2	11·2	10·0	9·4	,, ,,
,,	85380	♀	21·0	7·2	5·2	11·0	6·0	11·4	10·4	9·8	,, ,,
Strassburg	8. 8. 10. 12	♂	21·2	7·0	5·0	10·8	6·0	12·0	10·4	9·6	,, ,,
Switzerland: Geneva	668 Mottaz	♂	21·2	7·0	5·2	10·4	—	12·0	10·2	9·4	,, ,,
,,	1046 ,,	♂	21·0	7·0	5·2	10·6	—	12·0	10·2	9·4	,, ,,
,,	1028 ,,	♀	21·2	7·0	5·2	10·4	5·8	11·6	10·2	9·6	,, ,,
Chesières, Vaud	2209 ,,	♂	21·0	7·0	5·0	11·2	6·0	12·0	10·2	9·6	,, moderately worn.
,, ,,	2740 ,,	♂	21·2	7·0	5·2	11·2	6·0	12·0	10·4	9·4	,, ,,
Züberwangen, St. Gallen	4. 4. 5. 48	♂	22·0	7·2	5·2	11·0	6 0	12·0	10·0	9·0	,, much worn.
,, ,,	4. 4. 5. 49	♀	22·2	7·0	5·4	11·0	6·2	12·2	11·0	10·2	,, slightly worn.
,, ,,	4. 4. 5. 50	♀	22·0	7·2	5·4	11·0	6·0	12·0	11·0	10·0	,, ,,
,, ,,	4. 4. 5. 51	♀	22·2	7·4	5·4	11·2	6·0	12·0	11·0	10·0	,, ,,
St. Gallen	86497	♂	21·2	7·0	5·2	11·0	5·8	12 0	10·2	9·4	,, moderately worn.
Göschenen	124575	♀	20·2	7·2	4·8	10·6	5·6	10·8	10·0	9·2	,, slightly worn.
Andermatt	85788	♀	21·4	6·8	5·0	11·0	5·8	11·4	10·0	8·6	,, much worn.
Upper Murgsee	123618	♂	20·6	7·0	5·0	10·2	5·4	11·4	10·0	9·2	,, ,,

Switzerland: Upper Murgsee	123619	♂	21·2	6·8	5·0	10·8	5·4	11·2	10·4	9·8	Teeth slightly worn.
Meiringen	85941	♂	20·8	6·6	4·8	10·4	5·6	11·2	9·8	9·2	,, ,,
,,	85939	♀	20·0	7·0	5·0	10·4	5·4	11·0	10·0	9·2	,, ,,
,,	85947	♀	21·0	6·8	5·2	10·6	5·4	11·6	10·2	9·6	,, not worn.
Faido, Ticino	5. 8. 2. 20	♀	21·4	6·6	5·0	11·0	6·0	11·2	10·2	9·2	,, moderately worn.
Locarno, Ticino	5. 8. 2. 9.	♂	—	7·0	5·0	10·8	5·8	11·0	—	9·0	,, ,,
No exact locality	712. 45 Geneva*		—	6·6	5·2	—	—	—	10·8	—	,, slightly worn.
Italy: Vallombrosa	1. 8. 2. 1	♀	20·4	6·8	4·8	10·4	5·6	11·6	10·6	9·8	,, not worn.
Hungary: Hatszeg, Hunyad	3. 11. 8. 2	♂	21·0	6·8	5·0	10·8	6·0	11·0	10·4	9·4	,, ,,
,, ,,	3. 11. 8. 5	♂	20·6	6·6	5·0	10·6	5·6	11·0	9·8+	8·6+	,, much worn.
,, ,,	3. 11. 8. 6	♂	21·6	6·8	5·2	10·8	5·8	12·0	10·0	9·4	,, slightly worn.
,, ,,	3. 11. 8. 7	♂	20·2	6·4	5·0	10·6	5·6	11·0	9+	8+	,, much worn.
,, ,,	3. 11. 8. 8	♀	21·0	6·6	4·8	10·6	5·8	11·6	10·4	9·4	,, slightly worn.
,, ,,	3. 11. 8. 9	♀	21·4	6·6	5·0	10·4	5·6	11·8	10·8	9·8	,, not worn.
,, ,,	3. 11. 8. 11†	♀	21·4	7·0	5·2	10·6	5·8	12·0	10·4	9·8	,, slightly worn.
N. fodiens bicolor.											
England: Cambridgeshire	39. 9. 29. 26	♀	20·8	6·8	4·8	10·8	5·4	11·6	10·0	9·4	,, ,,
Lincolnshire	152468	♀	21·4	7·0	5·0	11·0	6·0	11·4	10·2	9·2	,, much worn.
Thornhaugh, Northants	152470	♀	20·8	6·8	5·2	10·8	6·0	11·2	9·6	8·4	,, moderately worn.
Tillingbourne Stream, Surrey	152469	♂	20·2	6·6	4·8	10·0	5·6	11·0	9·8	9·2	,, slightly worn.
	152471	♂	20·4	6·8	4·8	10·4	5·8	11·0	9·8	9·0	,, moderately worn.
Wellington, Somerset	152472	♂	19·6	6·6	4·6	10·4	5·6	10·6	9·8	9·2	,, slightly worn.
Yalding, Kent	152473	♂	19·8	6·6	4·8	10·2	—	10·4	9·6	9·0	,, ,,
Dunphail, Elgin	7. 7. 7. 2848	♂	20·2	6·2	4·8	10·4	5·6	11·0	9·6	8·8	,, much worn.
New Forest, Hampshire	7. 7. 7. 2845	♀	20·2	6·8	5·0	10·2	5·8	11·0	9·8	9·2	,, slightly worn.
,, ,,	7. 7. 7. 2846	♀	20·6	6·4	4·8	10·4	5·8	11·2	10·0	9·2	,, ,,
,, ,,	7. 7. 7. 2847	♀	20·8	6·4	4·8	10·8	5·6	11·4	10·0	9·2	,, ,,
,, ,,	7. 7. 7. 2849	♀	21·0	7·0	5·2	10·6	6·0	11·6	10·0	9+	,, much worn.
Basingstoke ,,	7. 7. 7. 4470	♀	20·4	6·8	5·0	10·8	5·4	11·6	10·2	9·2	,, moderately worn.
,, ,,	7. 7. 7. 4471	♀	21·2	7·0	5·0	10·8	5·4	11·8	10·0	9·0	,, ,,

* Type of *Crossopus ignotus* Fatio.

† Type of *Neomys fodiens naias* Barrett-Hamilton.

NEOMYS MILLERI Mottaz.

1907. *Neomys milleri* Mottaz, Mém. Soc. Zool. de France, xx, p. 22, September 20, 1907.
1910. *Neomys milleri* Trouessart, Faune Mamm. d'Europe, p. 58.

Type locality.—Chesières, Alpes Vaudoises, Switzerland. Altitude, 1,230 m.

Geographical distribution.—Pyrenees and Alps; Hungary. Details of distribution not yet known.

Diagnosis.—Slightly smaller than *Neomys fodiens*: tail with keel absent, or represented by a slight lengthening of hairs on under side of terminal third only; fringes on sides of feet not conspicuously developed; hind foot usually less than 17 mm.; tail usually less than 55 mm.; lachrymal foramen opening over point of contact between m^1 and m^2; anterior upper incisor slender.

External characters.—Similar to *Neomys fodiens*, except that the feet are less fringed and the tail lacks the definite keel on under side. When unworn the hairs on ventral surface of tail are slightly longer than those on upper side, and on terminal third this elongation is occasionally sufficient to produce a rudimentary keel; but there is never any trace of a well-defined ridge extending to base of tail. Caudal annulations slightly less distinct than in *Neomys fodiens*. Mammæ: *a* 1–1, *i* 1–1 = 10.

Colour.—The colour is similar to that of typical specimens of *Neomys fodiens fodiens*. Among the skins examined none shows any noticeable wash of brown or suffusion of buff on underparts.

Skull and Teeth.—The skull closely resembles that of *Neomys fodiens*, but may be distinguished by its smaller general size and relatively lower, more slender rostrum; lachrymal foramen over point of contact of m^1 and m^2. Teeth smaller throughout, a difference especially noticeable in the anterior upper incisor. Upper unicuspids with crowns longer and narrower than in *Neomys fodiens*, the long posterior portion especially noticeable in lateral view by comparison with height of cusp; cingula not so well developed as in the related species, and seldom, if ever, forming a postero-external cusp.

Measurements.—External measurements of type: head and body, 76; tail, 59; hind foot, 16; hind foot, including claws, 17. Average and extremes of ten specimens from the type locality: head and body, 77·4 (71–87); tail, 53·7 (50–59); hind foot, 15·8 (15–16·2). Average and extremes of six specimens from Untervatz, Grisons, Switzerland: head and body, 79·3 (75–82); tail, 46·8 (45–51); hind foot, 14–16 (14–15·4). Two adult males from Locarno, Ticino, Switzerland: head and body, 86; tail, 50 and 53; hind foot, 16 and 17. Average and extremes of three adult females from l'Hospitalet, Ariège,

France: head and body, 78 (75–80); tail, 50·6 (47–53); hind foot, 15·7 (15·4–16). Adult male from Barèges, Hautes-Pyrénées: head and body, 76; tail, 56; hind foot, 16·4. For cranical measurements see Table, p. 80.

Specimens examined.—Thirty-three, from the following localities:—
Switzerland: Near Geneva, 1; Lausanne, Vaud, 2 (U.S.N.M.); Chesières, Alpes Vaudoises, 10 (B.M. and Mottaz); Meiringen, Bern, 2 (U.S.N.M.); Untervatz, Grisons, 6 (U.S.N.M.); Züberwangen, St. Gallen, 3 (B.M. and U.S.N.M.); Sorengo, Ticino, 1 (U.S.N.M.); Locarno, Ticino, 2.
Italy: Porlezza, Como, 1 (Mottaz).
Austria-Hungary: Zubereč, Northern Hungary, 1.
France: L'Hospitalet, Ariège, 3; Luchon, Haute-Garonne, 1; Barèges, Hautes-Pyrénées, 1.

Remarks.—Though superficially resembling *Neomys fodiens* the round-tailed water-shrew is easily recognizable by the complete absence of any true keel on the tail. The slight elongation of the hairs in median region which sometimes occurs on terminal third of tail never results in the formation of a definite keel similar to that of the related species; while no trace of such a structure is ever present on basal half of tail. The smaller hind foot is usually diagnostic, though in this character there is a slight overlapping between the two species. Though in all essential respects true water-shrews, the members of the round-tailed group (*N. anomalus* of Spain, *N. milleri* of the Pyrenees, Alps and northern Hungary, and *N. teres* of Asia Minor) are less highly specialized than *Neomys fodiens*. Their habits, however, appear to be essentially similar to those of the common species, as the two animals are found together in localities where their ranges coincide.*

2 ♀.	L'Hospitalet, Ariège, France.	G. S. Miller (c).	8. 8. 4. 138, 140.
♀.	Chesières, Alpes Vaudoises, 1200 m. Switzerland.	C. Mottaz (p).	6. 2. 6. 4.
♀.	Züberwangen, St. Gallen, Switzerland. (*E. H. Zollikofer.*)	O. Thomas (p).	4. 4. 5. 52.
2 ♂.	Locarno, Ticino, Switzerland.	O. Thomas (c & p).	5. 8. 2. 6–7.
1.	Zubereč, Hungary.	Budapest Museum (e).	94. 3. 1. 26.

* At two localities in the Pyrenees (l'Hospitalet, Ariège and Barèges, Hautes-Pyrénées), where I found the two animals occurring together, both were taken alternately in the same traps set at the edge of mountain streams. In the original description of the species, however, Mr. Mottaz observes (p. 23) that according to his observations the round-tailed animal is the more inclined to wander away from the immediate vicinity of water. The habits of *N. anomalus* in North Central Spain appear to be as strictly aquatic as those of *N. fodiens*.

CRANIAL MEASUREMENTS OF *NEOMYS MILLERI*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case (median).	Mandible.	Maxillary tooth-row (entire).	Mandibular tooth-row (entire).	Observations.
Switzerland: Chesières, Alpes Vaudoises	6. 2. 6. 4	♀	20·4	6·4	4·8	10·4	6·0	11·0	10·0	9·2	Teeth not worn.
,, ,,	142580	♀	19·6	6·2	4·6	9·8	5·8	10·4	9·6	9·0	,, slightly worn.
,, ,,	1908 Mottaz*	♀	20·2	6±	5·0	10±	—	10·4	9·4	9·0	,, not worn.
,, ,,	1909 ,,	♂	20·2	6·2	5·0	10·2	6·0	11·0	9·8	9·0	,, ,,
,, ,,	1997 ,,	♂	19·8	6·2	5·0	10·0	5·6	10·4	9·8	9·0	,, ,,
Lausanne, Vaud	102276	♂	20·2	6·2	5·0	10·4	5·6	10·8	9·8	8·8	,, moderately worn.
,, ,,	102277	♀	19·6	6·2	4·8	9·8	5·4	10·8	9·4	8·6	,, ,,
Meiringen, Bern	85940	♀	20·6	6·6	4·8	10·2	5·4	10·8	10·0	9·2	
Züberwangen, St. Gallen	4. 4. 5. 52	♀	20·2	6·2	4·8	9·8	5·6	10·6	10·0	9·0	,, not worn.
,, ,,	115182	♀	20·0	6·2	4·6	10·0	5·6	10·6	9·8	9·0	,, moderately worn.
Untervatz, Grisons.	115183	♀	19·4	6·2	4·6	10·0	5·4	10·4	9·4	8·8	,, slightly worn.
,, ,,	115185	♀	19·6	6·2	4·8	10·0	5·4	10·8	9·8	9·0	,, ,,
,, ,,	115187	♀	19·0	6·0	4·4	9·8	5·4	10·0	9·2	8·6	,, ,,
,, ,,	115189	♂	19·8	6·0	4·6	10·0	—	9·8	9·6	9·0	,, ,,
Locarno, Ticino	5. 8. 2. 6	♂	21·0	6·8	5·0	10·2	5·8	11·4	10·0	9·0	,, moderately worn.
,, ,,	5. 8. 2. 7	♂	20·4	6·8	5·0	10·4	5·6	11·0	9·8	9·0	,, ,,
Sorengo ,,	115186	♀	20·2	6·6	5·2	10·4	5·6	11·0	9·6	9·0	,, much worn.
France: l'Hospitalet, Ariège	172117	♀	20·4	6·8	5·0	10·4	6·0	11·0	10·0	9·2	,, slightly worn.
,, ,,	8. 8. 4. 138	♀	20·4	6·4	5·0	10·0	5·6	11·0	10·0	9·2	,, not worn.
,, ,,	8. 8. 4. 140	♀	20·0	6·6	5·0	10·0	5·6±	11·0	10·0	9·2	,, slightly worn.
Barèges, Hautes-Pyrénées	172118	♂	21·0	6·6	5·0	10·6	5·8	11·2	9·8	9·0	,, much worn.

* Type.

NEOMYS ANOMALUS Cabrera.

1907. *Neomys anomalus* Cabrera, Ann. and Mag. Nat. Hist., 7th ser., xx, p. 214, September 1, 1907.

1907. *Neomys anomalus* Cabrera, Bol. Real Soc. Espan. Hist. Nat., Madrid, vii, p. 224. Published November, 1907.

1910. *Neomys fodiens anomalus* Trouessart, Faune Mamm. d'Europe, p. 57.

Type locality.—San Martin de la Vega, Madrid, Spain.

Geographical distribution.—Northern and central Spain.

Diagnosis.—Similar to *Neomys milleri*, but with longer tail (usually over 55 mm.), and larger hind foot (16·8 to 18 mm.). Mammæ: $a\ 1-1$, $i\ 4-4=10$.

Measurements.—Type specimen, male (from Cabrera): head and body, 73; tail, 60; hind foot, 17·5. Average and extremes of nine specimens from Silos, Burgos, Spain: head and body, 83·2 (76–88); tail, 60 (56–61); hind foot, 17·4 (17–18). Adult male and adult female from Barracas, Castellon, Spain: head and body, 99 and 100; tail, 53 and 52; hind foot, 17. For cranial measurements see Table, p. 82.

Specimens examined.—Twenty-two, from the following localities in Spain: Silos, Burgos, 9; La Granja, Segovia, 2; Barracas, Castellon, 2; Lérida, 9.

Remarks.—The Spanish water-shrew is well differentiated from *Neomys milleri* by its longer tail and larger hind foot. As yet no member of the keel-tailed group has been found in the Iberian Peninsula, though it is probable that *N. fodiens* occurs in the region north of the Ebro, and perhaps also in the Asturias.

2 ♂, 7 ♀.	Silos, Burgos, Spain.	G. S. Miller (c).	8. 8. 4. 22–30.
2 al.	La Granja, Segovia.	M. de la Escalera (c).	8. 7. 30. 6–7.
♂, ♀.	Barracas, Castellon. (*N. Gonzalez.*)	O. Thomas (f).	8. 2. 9. 41–42.

Genus **PACHYURA** de Sélys-Longchamps.

1839. *Pachyura* de Sélys-Longchamps, Études de Micromamm., p. 32 (*Sorex etruscus* Savi). Sub-genus of *Crocidura*.

1857. *Pachyura* Blasius, Säugethiere Deutschlands, p. 147 (Sub-genus of *Crocidura*).

1897. *Plerodus* Schulze, Mamm. Europ., in Helios, Abhandl. u. Vorträge Gesammtb. Naturwiss., xiv, p. 90 (*Crocidura suaveolens* Blasius = *Sorex etruscus* Savi).

Type species.—*Sorex etruscus* Savi.

Geographical distribution.—Africa and warmer portions of Asia; in Europe confined to the Mediterranean region.

Diagnosis.—Like *Crocidura* (p. 86), but with upper unicuspids 4–4, the dental formula: $i\ \frac{3\ 3}{1-1}$, $c\ \frac{1\ 1}{1-1}$, $pm\ \frac{2\ 2}{1-1}$, $m\ \frac{3-3}{3-3}=30$.

Remarks.—Although perhaps not forming a natural group, the 30-toothed species of *Crocidura* may for convenience be

CRANIAL MEASUREMENTS OF *NEOMYS ANOMALUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital breadth.	Breadth of brain-case.	Depth of brain-case (median).	Mandible.	Maxillary tooth-row (centre).	Mandibular tooth-row (centre).	Observations.
Spain: Silos, Burgos	8. 8. 4. 22	♂	21·0	6·6	5·0	11·0	5·8	11·4	10·0	9·4	Teeth slightly worn.
,, ,,	7292 Miller	♂	20·4	6·6	5·0	10·6	6·0	11·0	10·0	9·0	,, ,,
,, ,,	8. 8. 4. 23	♂	20·8	6·6	5·0	11·0	5·6	11·4	10·0	9·2	,, ,,
,, ,,	8. 8. 4. 24	♀	20·6	6·6	5·0	10·8	5·6	11·4	9·8	9·0	,, much worn.
,, ,,	8. 8. 4. 25	♀	20·6	—	4·8	10·8	5·8	10·8	9·8	8·8	,, moderately worn.
,, ,,	8. 8. 4. 26	♀	21·2	6·8	5·0	10·6	5·6	11·4	10·2	9·6	,, not worn.
,, ,,	8. 8. 4. 28	♀	20·0	6·6	5·0	10·0	5·6	10·6	9·8	9·0	,, slightly worn.
,, ,,	8. 8. 4. 29	♀	20·4	6·8	5·0	10·4	5·4	11·2	9·6	8·6	,, much worn.
,, ,,	8. 8. 4. 30	♀	20·0	6·6	5·0	10·4	5·4	11·0	10·0	9·2	,, slightly worn.
Barracas, Castellon	8. 2. 9. 41	♂	21·0	6·4±	5·0	10·4	5·8	11·4	10·0	9·0	,, moderately worn.
,, ,,	8. 2. 9. 42	♀	20·2	6·4	5·0	10·4	6·0	11·0	10·0	9·0	,, slightly worn.
La Granja, Segovia	8. 7. 30. 6	♀	19·2	6·4	5·2	—	—	10·8	9·4	8·6	,, moderately worn.
,, ,, ,,	8. 7. 30. 7	♀	20·0	6·4	5·0	10·4	5·6	11·0	9·6	9·0	,, slightly worn.

treated as members of a distinct genus. The only European species is immediately recognizable by its excessively small size.

PACHYURA ETRUSCA Savi.

1822. *Sorex etruscus* Savi, Nuovo Giorn. de' Letterati, Pisa, I, p. 60 (Pisa, Italy).
1835. [*Sorex*] *pachyurus* Küster, Isis, p. 77 (Cagliari, Sardinia).
1841. *Pachyura etrusca* Bonaparte, Iconogr. Faun. Ital., I, Indice distrib.
1857. *Crocidura suaveolens* Blasius, Säugethiere Deutschlands, p. 147.
1910. *Pachyura etrusca* Trouessart, Faune Mamm. d'Europe, p. 43.

Type locality.—Pisa, Italy.

Geographical distribution.—Italy and adjoining portions of the Mediterranean region.* Limits of range not known.

Diagnosis.—Much smaller than *Crocidura russula* (head and body, 35–40 mm.; hind foot, 7·6–8 mm.), but with tail (25–30 mm.) relatively longer, its ratio to head and body about 70; skull excessively small, its condylobasal length only about 12·8 mm., the dorsal profile nearly straight from front of nasal to back of parietals, usually a little concave in interorbital region, the brain-case narrow but even more flattened than in *Crocidura leucodon* and *C. mimula*; teeth not conspicuously different from those of the smaller European species of *Crocidura*, except for the presence of the fourth upper unicuspid, and their much smaller size (maxillary tooth-row about 6 mm.).

External characters.—In general external form *Pachyura etrusca* does not differ notably from *Crocidura russula* except in the relatively longer tail. The weight of a full grown individual is, however, probably not more than one-fourth or one-third that of an adult *C. russula*, and the head and feet are equally small in proportion, a character by which *Pachyura etrusca* may be easily distinguished from young individuals of the larger animal. Mammæ, $i\ 3 - 3 = 6$.

Colour.—Upper parts a uniform slaty brown, perhaps best described as drab-grey washed with light bister, the individual hairs slate-grey at base. Underparts faintly contrasted, rather pale drab-grey with silvery reflections in certain lights. Feet dull light slaty grey not noticeably contrasted with back. Tail like back above, usually becoming somewhat darker toward tip, lighter and more like belly below, but with no evident contrast between the colours of the two surfaces.

Skull.—Apart from the small size the skull differs from that of its European allies in several important characters. Most noticeable among these is the extreme flatness of the dorsal profile, which is essentially straight from nares to occipital, usually a little concave in interorbital region, while in the European forms of *Crocidura* it is usually a little convex throughout, and never evidently concave in interorbital region.

* Spain. See footnote, p. 86.—O. T.

The brain-case is excessively flattened, relatively more so than in *Crocidura mimula*, so that there is less contrast between its depth and that of rostrum. This flattening is not accompanied by any increase in breadth of brain-case, the ratio of which to condylobasal length is about 46, slightly less than in *Crocidura mimula*. Anteorbital foramen relatively large, its position normal. Lachrymal foramen over posterior half of m^1. Palate relatively short and wide. Mesopterygoid space relatively longer than in the European forms of *Crocidura*, its anterior border on line with posterior edge of third molar instead of distinctly behind it, its lateral borders nearly parallel, though slightly converging posteriorly; hamular excessively delicate, bowed outward and upward, its length relatively greater than in *C. russula*, and about equal to greatest breadth of fossa. Mandible not peculiar except for its small size (length about 7 mm. or less), and very delicate structure.

FIG. 16.
Pachyura etrusca.
Nat. size.

Teeth.—While in general, and aside from the presence of the fourth unicuspid, the teeth do not differ materially from those of the smaller European *Crocidurae* except in size, they show several peculiarities in form. The anterior upper incisor projects more strongly forward, and has the anterior cusp rather shorter than in the species of *Crocidura*, while the posterior cup is more distinctly separated from the cingulum, these two characters together imparting to the tooth a form somewhat suggesting that assumed in *Sorex*. First unicuspid relatively larger and higher than in *Crocidura russula*, its cingulum less curved, and its width distinctly exceeding that of palate instead of barely equalling it. Contrast in both height and crown area of first and second unicuspids greater than in *C. russula*, the area of second about one-third that of first instead of evidently more than one-third. Third unicuspid slightly larger than second. Fourth about half as large as third, crowded inward from the tooth-row, but visible from the outside through space separating third unicuspid from large premolar, the width of this space rather more than half diameter of crown of fourth unicuspid. Large premolar as in *C. leucodon*, except that cutting blade is shorter and even higher, and posterior border of crown is less concave. Upper molars with hypocones less distinct than in *C. russula*, but otherwise not showing any tangible peculiarities. Mandibular teeth essentially as in *Crocidura russula* and *C. leucodon*, but posterior section of third molar even more reduced.

Measurements.—Average and extremes of six specimens from Florence, Italy: head and body, 38·5 (36–42); tail, 27·1 (26–28); hind foot, 7·7 (7·6–7·8). Adult male and female from near Turin, Italy: head and body, 42 and 40; tail, 28 and 27; hind foot, 7·8 and 7·4. Adult male and female from near

CRANIAL MEASUREMENTS OF *PACHYURA ETRUSCA*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case (median).	Mandible.	Maxillary tooth-row (entire).	Mandibular tooth-row (entire).	Observations.
Italy: Pisa . . .	69. 3. 4. 1	♀	13·2	4·0	3·0	6·0	2·8	6·4	5·6	5·2	Teeth moderately worn.
,, . . .	Ta. 222 Mottaz	♀	12·8	4·0	3·0	6·0	2·8	6·6	5·8	5·2	,, not worn.
,, . . .	Ta. 181 ,,	♀	13·2	4·0	3·0	6·0	2·8	6·6	5·8	5·2	,, slightly worn.
,, . . .	Ta. 182 ,,	♂	13·0	4·2	3·2	6·0	2·8	6·8	5·6	5·2	,, ,,
,, . . .	Ta. 183 ,,		12·8	4·2	3·0	6·0	2·8	6·6	5·8	5·2	,, ,,
Florence . .	105380	♂	12·4	4·2	3·0	6·2	2·8	6·6	5·6	5·2	,, ,,
Borzoli. . .	Genoa Mus.	♀	13·2	4·2	3·4	6·2	3·0	7·0	6·0	5·4	,, ,,
Sicily	52. 2. 26. 22	♂	12·4	4·0	3·0	6·2	2·8	6·2	5·4	5·0	,, ,,
,, ...	52. 2. 26. 23	♀	12·6	3·8	3·0	6·0	2·8	6·2	5·4	5·0	,, ,,
Sardinia: Assuni . .	173176	♀	12·8	4·0	3·0	6·2	2 8	6·8	5·4	5·2	,, ,,

Genoa, Italy: head and body, 41 and 42: tail, 26 and 28; hind foot, 7·6 and 8·0. Adult female from Sassari, Sardinia: head and body, 41; tail, 29; hind foot, 7·8. For cranial measurements see Table, p. 85.

Specimens examined.—Twenty-nine, from the following localities:—
ITALY: Near Turin, 2 (Genoa); Perti, Finalborgo, 2 (Genoa); near Genoa, 5 (U.S.N.M. and Genoa); Pisa, 5 (B.M. and Mottaz); Florence, 6 (U.S.N.M. and Mottaz); Tuscany, 2; Rome, 1 (Genoa); no exact locality, 2.
SICILY: No exact locality, 2.
SARDINIA: Assuni, 1 (U.S.N.M.). No exact locality, 1.
GREECE: Lamia, 1.

1 al.	Pisa, Italy.	Marquis G. Doria (P).	69. 3. 4. 1.
2 al.	Tuscany.	(No history).	
1 al.	Italy.	Zoological Society's Collection.	55. 12. 26. 295.
Skeleton.	Italy.	Purchased.	58. 10. 21. 13.
♂, ♀ al.	Sicily.	Purchased (Parzudaki).	52. 2. 26. 22–23.
1 al.	Sardinia.	Hon. N. C. Rothschild (P).	11. 10. 1. 1.
1 al.*	Lamia, Greece.	E. MacDonell (P).	8. 7. 22. 1.

Genus **CROCIDURA** Wagler.

1832. *Crocidura* Wagler, Isis, p. 275 (*Sorex leucodon* Hermann).
1857. *Crocidura* Blasius, Säugethiere Deutschlands, p. 137.
1869. *Leucodon* Fatio, Faune Vert. Suisse, I, p. 132 (substitute for *Crocidura*).
1897. *Paurodus* Schulze, Mamm. Europ., in Helios, Abhandl. u. Vorträge Gesammtb. Naturwiss., XIV, p. 90 (*Sorex leucodon* Hermann and *S. araneus* Schreber = *S. russulus* Hermann).

Type species.—*Sorex leucodon* Hermann.

Geographical distribution. Africa and warmer portions of Europe and Asia, including the Malay Archipelago: in Europe, north to northern Holland and central Germany, west to the Atlantic coast and the Channel Islands. Absent from Great Britain and Ireland.

Characters.—Upper unicuspid teeth 3–3 (dental formula: $i\frac{2}{1-1}\ c\frac{1}{1}\ p\frac{1}{1}\ pm\frac{1}{1}\ m\frac{3-3}{3\ 3} = 28$: posterior lobe of upper incisor noticeably less than half as high as main cusp: anterior lower incisor without lobes on cutting edge: third lower molar with hypoconid and entoconid coalesced, so that form of tooth is strikingly different from that of other molars, its crown 4-cusped instead of 5-cusped: second lower unicuspid without rudimentary second cusp and commissure: teeth white throughout: skull heavier and more robust than in *Sorex* and *Neomys*, with conspicuously deeper rostrum and less contrast between width of brain-case and that of anterior portion; rudimentary zygomatic process of maxillary obsolete; external form rather heavy; ear rising noticeably

* ♂, 2 ♀. Marismas, Lower Guadalquivir, Spain. A. Chapman (C & P). 11. 12. 19. 1–3.

Received December, 1911.—O. T.

above fur, the meatus closed by two valves as in *Neomys;* tail somewhat thickened, its surface covered with short hairs, among which are sprinkled numerous longer ones; habits terrestrial.

Remarks.—Though not highly modified in external peculiarities the genus *Crocidura* is the least primitive group of shrews occurring in Europe. This is indicated by the reduced number of upper unicuspids, but is more clearly shown by the highly modified form of the third lower molar and the completely unicuspid character of the lower premolar. Among the European members of the family *Soricidæ* the species of *Crocidura* may at once be recognized by their moderate size, entirely white teeth, large ears, and by the presence of long, loosely spreading hairs scattered over the surface of the tail. Badly prepared specimens, in which the true characters are obscured, may often be detected among skins of *Sorex* by the noticeable silvery reflections on hairs of back. Eight species are now known to occur in western Europe, while the number of forms thus far described from other portions of the range of the genus is not far from one hundred.

KEY TO THE EUROPEAN FORMS OF *CROCIDURA*.

Tail decidedly more than half as long as head and body, the ratio normally varying from 70 to 80.
  Hind foot about 14 mm. (Sicily)..... *C. caudata*, p. 110.
  Hind foot 11 to 12·5 mm.
    Upper tooth-row about 8·6 mm. (Corsica)..... *C. cyrnensis*, p. 111.
    Upper tooth-row about 8 mm. (Balearic Islands)... *C. balearica*, p. 112.
Tail about half as long as head and body, the ratio normally varying from 40 to 60.
  Condylobasal length of skull 16 to 17·6 mm.
    Second upper unicuspid with crown area about equal to that of third (Crete)..... *C. caneæ*, p. 109.
    Second upper unicuspid with crown area distinctly less than that of third..... *C. mimula*, p. 94.
      Colour tending to be pale and greyish (Basque Provinces, Spain)..... *C. m. cantabra*, p. 99.
      Colour tending to be dark and brownish.
        Brain-case not decidedly flattened (Charente, France)..... *C. m. iculisma*, p. 98.
        Brain-case decidedly flattened (entire range of species, western portion excepted)... *C. m. mimula*, p. 95.
  Condylobasal length of skull 17·6 to 20·4 mm. (usually more than 18 mm.).
    Brain-case about half as high as wide or less.
      Animal conspicuously bicolor; condylobasal length of skull usually more than 19 mm. (Central Europe, south into Italy)..... *C. leucodon*, p. 88.
      Animal obscurely bicolor; condylobasal length of skull usually 18 to 19 mm. (Sicily)..... *C. sicula*, p. 108.
    Brain-case more than half as high as wide..... *C. russula*, p. 99.
      Condylobasal length of skull usually 19 to 20·4 mm. (Central Europe, south into Italy)..... *C. r. russula*, p. 101.
      Condylobasal length of skull usually 18 to 19 mm.
        Colour a dark, coppery-brown (Portugal)..... *C. r. cintræ*, p. 108.
        Colour a pale drab-brown (Spain and south-western France)..... *C. r. pulchra*, p. 103.

CROCIDURA LEUCODON Hermann.

1780. *Sorex leucodon* Hermann in Zimmermann, Geogr. Gesch., II, p. 382 (vicinity of Strassburg, Germany).
1781. *Sorex leucodon* Hermann in Schreber, Säugthiere, pl. CLIX.
1782. *Sor[ex] leucodon* Hermann, Tabula Affinitatum Animalium, p. 79 (footnote).
1792. *Sorex albipes* Kerr, Anim. Kingd., p. 208 (based on Pennant's account of *S. leucodon* Hermann).
1832. *Croc[idura] leucodon* Wagler, Isis, p. 275.
1857. *Crocidura leucodon* Blasius, Säugethiere Deutschlands, p. 140.
1869. *Leucodon microurus* Fatio, Faune Vert. Suisse, I, p. 173 (Substitute for *leucodon*).
1897. [*Crocidura*] *leucodus* Schulze, Mammalia Europæa, p. 18 (Substitute for *leucodon*).
1910. *Crocidura russula leucodon* Trouessart, Faune Mamm. d'Europe, p. 44.

Type locality.—Vicinity of Strassburg, Germany.

Geographical distribution.—Central Europe, from Belgium to Hungary; south into Italy. Not known from the Iberian Peninsula.

Diagnosis.—Size large (among the European species); hind foot, 11 to 13 mm.; condylobasal length of skull, 18·4 to 20 mm.; upper tooth-row, 8·8 to 9·0 mm.; tail short, its actual length 28 to 38 mm., its ratio to head and body usually ranging from 38 to 43; skull with brain-case noticeably depressed, its height less than half its width; large upper premolar with antero-external cusp rather large, its height usually greater than that of first unicuspid; colour of underparts whitish, strongly contrasted with rather slaty brown of back, the line of demarcation along sides well defined.

External characters.—Fur shorter and more dense than in *Sorex araneus*, the length of hairs at middle of back about 3·5 mm. in summer, 5 mm. in winter, its texture not specially modified; a few slightly elongated hairs (8 mm.) on flanks and across rump. Eyes small and inconspicuous; ears small but rising conspicuously above fur, the two well developed valves a conspicuous feature of the ear in freshly killed specimens. Feet not peculiar in form; less slender than in *Sorex araneus*, finely pubescent on dorsal surface and on lateral portions of posterior half of sole; fingers proportioned as in *S. araneus*, but graduation less, especially in hind foot; pads 6–6, those on palm distinct though somewhat crowded, the surface of palms and soles finely rugose between the pads. Tail less slender than in *Sorex* and *Neomys*, nearly terete or with under side somewhat flattened, its length equal to about half that of head and body, its hairs of two kinds: (*a*) finely appressed hairs less than 1 mm. in length, nearly concealing the annulations and forming a very slight pencil; and (*b*) loosely spreading hairs about 5 mm. long, rather thickly sprinkled among the others; annulation ill-defined, about 35 to the centimeter at middle. Mammæ, *i* 3—3 = 6.

Colour.—Upper parts varying from a slaty drab to dull russet, the hairs with a slight metallic gloss and with silvery reflections, which in certain lights produce an evident effect of fine speckling. Underparts and inner surface of limbs buffy white, dulled to a varying degree by the slaty under colour, the chin and throat often suffused with cream-buff. Line of demarcation sharply defined, extending just below ear and eye and alongside of muzzle to middle of pad. The two extremes of colour probably represent ill-defined dichromatic phases. Most of the specimens examined are in some degree intermediate. Feet dull whitish, often irregularly clouded with drab. Tail sharply bicolor, whitish below, concolor with back above, the longer hairs silvery grey.

Skull.—The skull is slightly larger than that of *Sorex araneus* and noticeably more heavily built, particularly that portion lying in front of brain-case, all of which is both broadened and deepened, so that the general outline tapers less conspicuously from behind forward, whether skull is viewed from above or from the side. Brain-case less well marked off from interorbital region than in the European species of *Sorex* and *Neomys*, its main sutures closing early in life. Brain-case slightly longer than broad, its posterior outline rounded but broken by the slightly projecting points of the condyles, its antero-external border straight, sharply angled in front; sagittal crest low but evident in adult skulls, meeting the complete lambdoid crests posteriorly. Depth of brain-case at middle slightly but constantly less than half greatest breadth (see fig. 20, page 100). Dorsal profile with a slight concavity at front of brain-case and slight convexity over middle of rostrum. Nares squarely truncate posteriorly, the lateral wall abruptly angled near middle. Anteorbital foramen relatively smaller than in *Sorex araneus*, and region between it and edge of alveolus distinctly wider. Lachrymal foramen over metastyle of m^1. Plate forming outer wall of anteorbital canal nearly three times as wide as lachrymal foramen. Angular shelf-like region over posterior molars broader and more prominent than in the European species of *Sorex*, but rudimentary zygomatic process of maxillary reduced to the merest trace. Mesopterygoid fossa as in *Sorex araneus*; floor of brain-case between tympanic bones narrower and with distinct median ridge.

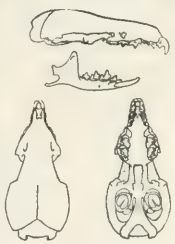

FIG. 17.
Crocidura leucodon.
Nat. size.

Teeth.—Dentition noticeably heavier than in the European species of *Sorex* and *Neomys*, the difference in general aspect heightened by the absence of brown colouring matter on points of cusps. Anterior upper incisor with main cusp long and slender, abruptly hooked downward; basal lobe low and

triangular, its height less than half that of main cusp and only a little more than half that of first unicuspid tooth. General form of first incisor not unlike that of *Neomys fodiens*, but with even more contrast between height of the two cusps. Anterior lower incisor simple, rather robust, the shaft slightly tapering, the point slightly bent upward, the cutting edge without lobes. Upper unicuspids robust, strongly contrasted in size. First about double the height of second and third, the points of which are nearly in line with that of basal lobe of anterior incisor. Its crown is somewhat longer than broad, with main axis slightly oblique to that of tooth-row. In lateral view it is nearly triangular, with anterior border about half as long as upper and lower. Cutting edge essentially as in *Neomys*, but better developed and reaching posterior border of tooth somewhat outside of middle. Crushing surface well developed, occupying about one-third area of crown. Second and third unicuspids approximately equal, in both height and crown area, to basal lobe of anterior incisor, their crowns distinctly narrower as well as much shorter than that of first unicuspid, their cutting ridge and crushing surface less well differentiated than in first. Second smaller than third, its crown about as broad as long. Third separated from large premolar by a slight space, its crown longer than broad, its cusp about equal in height to paracone of large premolar. Lower unicuspids essentially alike in form, the second differing from that of *Sorex* and *Neomys* in the complete absence of the rudimentary second cusp. First low, narrow and long; second high, its crown about as broad as long. Upper cheek-teeth with crowns narrower than in *Sorex* and

FIG. 18.
Crocidura leucodon. Anterior teeth in profile. × 5.

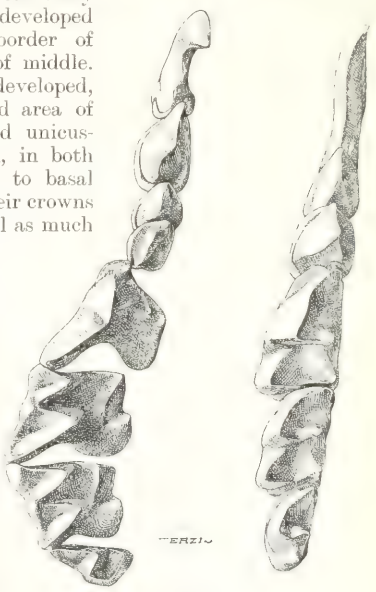

FIG. 19.
Crocidura leucodon. Teeth × 10.

Neomys, the emargination of posterior border deeper, particularly in pm^4, and hypocones more distinct. Large upper premolar with antero-external cusp (paracone) well developed, its height usually about equal to that of third unicuspid or somewhat more, the distance from its point to well-defined angle in cingulum over anterior root of tooth distinctly more than half length of anterior border of main cusp; posterior cutting blade high, the angle formed between its edge and the moderately projecting point of main cusp ill-defined and obtuse. Third upper molar actually as well as relatively smaller than in *Sorex araneus*, but containing the same elements. Lower cheek-teeth essentially as in *Sorex araneus* except for the peculiarities of m_3 characteristic of the genus.

Measurements.—Average and extremes of nine specimens from Étupes, Doubs, France: head and body, 78·3 (70–87); tail, 35·3 (32–39); hind foot, 12·3 (12–13). Average and extremes of nine specimens from Untervatz, Grisons, Switzerland: head and body, 81 (77–85); tail, 31·6 (29–34); hind foot, 12·5 (11·8–13). Average and extremes of four specimens from Lugano, Ticino, Switzerland: head and body, 80 (77–81); tail, 32·2 (31–36); hind foot, 12·5 (11·8–13). Average and extremes of three specimens from Florence, Italy (in alcohol, bodies contracted): head and body, 63·3 (63–64); tail, 34·3 (32–36); hind foot, 12·3 (11·6–13). For cranial measurements see Table, p. 92.

Specimens examined.—Sixty-six, from the following localities:—

Belgium: Esneux, Liége, 2; Waremme, Liége, 1 (U.S.N.M.).

France: Dinan, Brittany, 1; Paris, 1 (U.S.N.M.); Manonville, Meurthe-et-Moselle, 1; Étupes, Doubs, 14 (B.M. and Mottaz).

Germany: Brunswick, 1 (U.S.N.M.); Nussberg, Brunswick, 1; Frankfurt, Hessen-Nassau, 1; Taucha, Saxony, 1 (U.S.N.M.); Marxheim, Bavaria, 4; Ummerstadt, Thüringen, 1; no exact locality, 1.

Austria-Hungary: Hatszeg, Hunyad, Transylvania, 1.

Switzerland: Geneva, 3 (Mottaz); Brünig, Bern, 1 (U.S.N.M.); Meiringen, Bern, 4 (U.S.N.M.); Untervatz, Grisons, 15 (B.M. and U.S.N.M.); Grisons, no exact locality, 1; Lugano, Ticino, 4 (U.S.N.M.); Züberwangen, St. Gallen, 1.

Italy: Porlezza, Como, 1 (Mottaz); Boccadassa, Genoa, 1 (Genoa); Pisa, 1 (Mottaz); Florence, 3 (U.S.N.M. and Mottaz); Rome, 1.

Remarks.—This species is recognizable among the European members of the genus by its sharply bicolor pattern of colouration and by the low, flattened brain-case. From *Crocidura russula*, the only species with which it is likely to be confused, it is further distinguished by the peculiarities of the large upper premolar, a tooth whose higher cutting edge, better developed paracone and more prominent cingulum indicate a degree of efficiency superior to that of the corresponding tooth in the related animal.

CRANIAL MEASUREMENTS OF *CROCIDURA LEUCODON*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case (median).	Mandible.	Maxillary tooth-row (entire).	Mandibular tooth-row (entire).	Observations.
Belgium: Esneux, Liége . .	95. 1. 1. 1		20·0	7·2	5·0	9·8	4·8	10·4	9·0	8·4	
,, . .	95. 1. 1. 2	♀	19·0	6·8	4·8	9·2	4·6	10·8	9·0	8·4	
Waremme, Liége .	86057	♂	19·2	6·8	4·8	9·2	4·6	10·4	9·0	8·4	Teeth slightly worn.
France: Étupes, Doubs . .	8. 8. 10. 33	♂	19·0	6·8	4·8	9·4	4·6	10·4	9·0	8·4	,, ,,
,, ,, . .	8. 8. 10. 34	♂	19·2	6·6	4·6	9·4	4·6	10·2	8·4	7·6	,, much worn.
,, ,, . .	8. 8. 10. 35	♂	19·4	7·0	4·8	9·8	4·8	10·4	9·0	8·4	,, slightly worn.
,, ,, . .	8. 8. 10. 36	♂	18·8	6·8	4·6	9·6	4·6	10·0	8·8	8·0	,, not worn.
,, ,, . .	152495	♂	19·2	6·8	4·8	9·4	4·6	10·2	8·4	7·8	,, moderately worn.
,, ,, . .	5651 Mottaz	♀	19·0	7·0	4·8	9·4	4·6	10·4	9·0	8·0	,, slightly worn.
,, ,, . .	8. 8. 10. 42	♀	18·6	6·6	4·6	9·2	4·4	10·0	8·8	8·0	,, not worn.
,, ,, . .	152494	♀	19·0	6·6	4·6	9·4	4·4	10·2	8·8	8·0	,, slightly worn.
,, ,, . .	152493		19·4	6·4	4·6	9·4	4·4	10·8	9·0	8·0	,, ,,
,, ,, . .	8. 8. 10. 37		19·4	7·0	4·8	9·8	4·6	10·6	9·0	8·2	,, ,,
Germany: Marxheim, Bavaria .	8. 9. 8. 3	♂	18·4	6·4	4·4	9·2	4·4	10·4	8·8	8·0	,, ,,
,, ,, .	152497		19·0	7·0	4·8	9·4	4·6	10·6	8·8	8·0	,, moderately worn.

Germany: Marxheim, Bavaria .	8. 9. 8. 2		19·8	7·2	5·0	9·6	4·6	10·8	9 0	8·4	Teeth slightly worn.
Ummerstadt, Thüringen . . .	152496		18·8	6·4	4·6	—	4·4	10·4	8·8	8·0	,, ,,
Hungary: Hatszeg, Hunyad .	3. 2. 2. 16	♀	18·8	6·4	4·6	9·0	4·4	10·2	8·8	8·2	,, ,,
Switzerland: Brünig . .	85825	♂	18·4	6·2	4·6	8·8	4·2	10·0	8·8	8·2	,, not worn.
Meiringen . .	85951	♂	20·0	6·6	4·8	9·2	4·6	10·6	9·0	8·2	,, moderately worn.
,, . .	85952	♂	18·8	6·2	4·6	8·8	4·0	10·4	8·8	8·0	,, slightly worn.
,, . .	85955	♂	18·4	6·2	4·6	9·2	4·2	10·4	8·8	8·2	,, ,,
,, . .	85956	♂	19·2	6·2	4·6	9·0	4·2	10·6	8·8	8·2	,, ,,
Untervatz, Grisons	123557	♂	19·6	6·8	4·8	9·2	4·6	10·6	9·0	8·2	,, ,,
,, ,,	123558	♂	19·8	6·8	4·8	9·4	4·6	10·6	8·8	8·0	,, moderately worn.
,, ,,	123559	♂	19·4	6·6	4·6	9·4	4·6	10·6	9·0	8·2	,, slightly worn.
,, ,,	115191	♀	19·2	6·4	4·6	9·2	4·6	10·4	8·8	8·2	,, moderately worn.
,, ,,	123555	♀	18·8	6·4	4·6	9·2	4·4	10·2	8·8	8·0	,, ,,
Lugano, Ticino .	111546	♀	19·2	6·4	4·4	9·0	4·4	10·4	8·8	8·0	,, much worn.
,, ,, .	115193	♂	19·2	6·4	4·6	9·0	4·4	10·4	8·8	8·2	,, slightly worn.
Italy: Pisa	Ta. 221 Mottaz	♀	19·6	6·6	5·0	9·4	4·6	11·0	9·2	8·6	,, not worn.
Florence . . .	Ta. 186 Mottaz	♂	19·2	6·4	4·8	9·2	4·4	10·2	9·0	8·2	,, slightly worn.
,, . . .	105383	♂	18·6	6·6	4·2	9·0	4·2	—	8·6	—	,, ,,
Rome	11. 1. 2. 103	♂	—	6·4	4·6	—	—	10·4	9·0	8·2	,, ,,

2 ♀, 1.	Esneux, Liége, Belgium (*H. Grönvold.*)	Lord Lilford (P).	95. 1. 1. 1–2.
♂.	Dinan, Brittany, France.	G. Barrett-Hamilton (P).	11. 1. 2. 158.
♂.	Manonville, Meurthe-et-Moselle.	Lord Lilford (P).	8. 9. 8. 1.
5 ♂, 4 ♀.	Étupes, Doubs, 350 m. (*C. Mottaz.*)	O. Thomas (P).	8. 8. 10. 33–41.
2 ♀.	Marxheim, Bavaria, Germany.	Lord Lilford (P).	8. 9. 8. 2–3.
1.	Frankfort, Hessen-Nassau.	Dr. Dieffenbach (P).	47. 1. 8. 50.
♂.	Nussberg, Brunswick.	G. Barrett-Hamilton (P).	11. 1. 2. 90.
1 al.	Germany.	Tomes Collection.	7. 1. 1. 45.
♀.	Hatszeg, Transylvania, 1500 ft. Hungary.	C. G. Danford (C).	3. 2. 2. 16.
3 ♂, 4 ♀.	Untervatz, Grisons, Switzerland. (*E. H. Zollikofer.*)	O. Thomas (P).	4. 4. 5. 21–22. 10. 8. 16. 9–13.
♀ sk.	Grisons, 550 m. (*E. H. Zollikofer.*)	O. Thomas (P).	4. 4. 5. 20.
♀.	Lugano, Ticino. (*E. H. Zollikofer.*)	O. Thomas (P).	10. 8. 16. 15.
♀.	Züberwangen, St. Gallen. (*E. H. Zollikofer.*)	O. Thomas (P).	10. 8. 16. 14.
♂.	Rome. (*C. Coli.*)	G. Barrett-Hamilton (P).	11. 1 2. 103.

CROCIDURA MIMULA Miller.

(Synonymy under subspecies.)

Geographical distribution.—Central Europe from north-western Spain through France, Switzerland, central Germany and northern Hungary to Roumania and Bulgaria, south into Italy and Greece.

Diagnosis.—Size less than in *Crocidura russula* and *C. leucodon* (hind foot, 10 to 12 mm.; condylobasal length of skull, 16 to 17·6 mm.); skull and teeth resembling those of *C. leucodon*, the brain-case nearly as much depressed, its height seldom more than half width, the third unicuspid similarly low as compared with small anterior cusp of large premolar; colour not very different from that of *C. aranea*, the upper and lower surfaces of body not strongly contrasted, and no line of demarcation along sides.

Colour.—Upper parts varying from a dull russet tinged with sepia to a dark hair-brown with a tinge of drab, the hairs with metallic gloss and silvery reflections; underparts varying from dull ochraceous-buff to greyish cream-buff, never sharply defined from colour of back and sides. Feet buffy whitish, usually with some dark clouding. Tail greyish or brownish, very obscurely bicolor.

Skull and teeth. Except for their noticeably smaller size the skull and teeth closely resemble those of *Crocidura leucodon*, though the brain-case is less constantly flattened, sometimes assuming a form essentially like that in *C. russula*. Plate forming

outer wall of anteorbital canal narrower than in *C. leucodon*, its width scarcely twice that of lachrymal foramen. Large upper premolar with high cutting blade and well developed paracone, the form and size of which relatively to main cusp and to third unicuspid are exactly as in *C. leucodon*.

Measurements.—According to measurements made by various collectors, the head and body varies from 55 to 72 mm., tail from 28 to 40 mm., and hind foot from 10 to 12 mm. The condylobasal length of skull ranges between 16·0 and 17·6 mm., and length of upper tooth-row between 7·2 and 8·0 mm.

Remarks. – *Crocidura mimula* differs from the other continental European members of the genus, in its small size, a character in which it is approached by the small races of *C. russula*, though not sufficiently to cause any confusion. In addition to the typical form two geographical races have been described, one from south-western France, the other from northern Spain, the status of neither of which is clearly understood.

Crocidura mimula mimula Miller.

1839. ?? [*Crocidura aranea*] var. *minor* de Sélys-Longchamps, Études de Micromamm., p. 35 (Silesia).

1901. *Crocidura mimula* Miller, Proc. Biol. Soc., Washington, xiv, p. 95, June 27, 1901 (Züberwangen, St. Gallen, Switzerland). Type in U.S. National Museum.

1901. *Crocidura antipæ* Matschie, Sitz.-Ber. Gesellsch. Naturforsch. Freunde, Berlin, p. 228, November, 1901 (Siulnita and Barza, Roumania).

1902. [*Crocidura*] *minuta* Lydekker, Zool. Record, xxxviii (1901), Mamm., p. 27 (Accidental renaming of *mimula*).

1910. *Crocidura mimula* and *C. antipai* Trouessart, Faune Mamm. d'Europe, pp. 46, 48.

Type locality.—Züberwangen, St. Gallen, Switzerland.

Geographical distribution.— Range of the species from the Rhone Valley eastward.

Diagnosis. –Size maximum for the species; skull with braincase tending to be strictly of the flattened type; colour usually dark.

Measurements. –External measurements of type: head and body, 72; tail, 33; hind foot, 11. A male and female from Untervatz, Grisons, Switzerland: head and body, 71 and 65; tail, 35 and 35; hind foot, 10 and 11. A male and female from Marxheim, Bavaria: head and body, 71 and 58; tail, 36 and 30; hind foot, 10 and 10. Average and extremes of four specimens from Haida, Arva, Bohemia: head and body, 59·7 (55–65); tail, 30 (28–32); hind foot, 11·5 (11–12). A male from Gageni, Roumania, and female from Bustenari, Roumania: head and body, 64 and 66; tail, 31 and 34; hind foot, 11 and 11. Two adult males from Agay, Var, France: head and body, 64 and 66; tail, 35 and 34; hind foot, 11 and 11. Adult female from Viareggio, Italy: head and body, 70; tail, 38; hind foot, 11·6.

CRANIAL MEASUREMENTS OF *CROCIDURA MIMULA*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case (median).	Mandible.	Maxillary tooth-row (entire).	Mandibular tooth-row (entire).	Observations.
C. mimula mimula.											
France: Agay, Var . . .	8. 8. 4. 162	♂	17·6	5·8	4·0	8·2	4·6	9·4	7·8	7·2	Teeth moderately worn.
,, ,, . . .	8. 8. 4. 163	♂	17·4	5·8	4·0	8·2	4·4	9·2	7·8	7·0	,, much worn.
Germany: Marxheim, Bavaria .	152480	♀	—	5·4	4·0			9·6	7·6	7·0	,, slightly worn.
,, ,, .	8. 9. 8. 4	♂	17·0	5·6	4·0	8·0	4·0	9·4	7·6	7·0	,, ,,
Austria-Hungary: Haida, Bohemia	152481	♀	16±	5·6	4·0	8·0	—	9·0	7·2	6·6	,, ,,
,, ,,	8. 9. 8. 5		—	5·6	4·0	—	-	9·0	7·6	6·8	,, not worn.
,, ,,	8. 9. 8. 6		17·0	5·6	4·0	8·4	4·0	9·2	7·4	6·8	,, moderately worn.
,, ,,	152482	♀	16·8	5·6	4·2	8·4	4·0	9·2	7·4	7·0	,, slightly worn.
Hatszeg, Hunyad	3. 2. 2. 12			5·6	4·0	—		8·6	7·6	7·0	,, ,,
Roumania: Gageni . . .	4. 4. 6. 11	♂	17·0	5·6	4·0	8·2	4·0	9·4	7·6	7·0	,, ,,
Bustenari . . .	4. 4. 6. 12	♂	-	5·4	4·0	-	—	9·0	7·6	7·0	,, moderately worn.
Bulgaria: Sofia	Andersen	♀	17·2	5·8	4·2	8·2	4·4	9·6	7·4	6·8	,, ,,

Switzerland: Untervatz, Grisons .	4. 4. 5. 21	♂	16·0	5·8	4·0	8·0	4·0	9·0	7·6	7·0	Teeth moderately worn.
,, ,, .	4. 4. 5. 22	♀	17·0	5·8	4·0	8·0	4·0	9·2	7·6	7·0	,, ,,
Züberwangen, St. Gallen . . .	105801*	♀	16·0	5·8	4·0	8·0	3·8	8·8	7·2	6·6	,, ,,
Davesco, Ticino .	115195	♀	17·0	5·4	4·2	8·2	4·4	9·2	7·8	7·0	,, much worn.
Locarno ,, .	5. 8. 2. 1	♂	17·4	—	—	8·4	4·6	9·0	8·0	7·0	,, slightly worn.
Italy: Porlezza, Como . . .	Mo. 110 Mottaz		17·0	6·0	4·0	8·2	4·0	9·0	7·6	7·0	,, ? ,,
,, ,, . . .	Mo. 111 ,,		17·2	5·8	4·0	8·0	4·0	9·4	7·8	7·2	,, ? ,,
,, ,, . . .	Mo. 112 ,,		16·8	5·8	4·0	8·0	3·8	9·0	7·6	7·0	,, ? ,,
,, ,, . . .	Mo. 113 ,,		17·0	5·4	4·0	8·0	4·0	9·2	8·0	7·2	,, ? ,,
Viareggio	5. 8. 2. 21	♀	17·4	—	—	8·2	4·6	—	8·0	—	,, ? ,,
,, ...	5. 8. 3. 1	♀	17·6	5·8	4·2	8·4	4·4	9·6	8·0	7·2	,, moderately worn.
Rome	11. 1. 2. 97	♂	—	6·0	4·2	—	—	9·2	7·8	7·0	,, slightly worn.
Greece: Corfu	8. 10. 1. 8	♂	17·6	5·6	4·2	8·2	4·6	9·8	7·8	7·2	,, moderately worn.
,, ...	152479	♀	17·6	5·6	4·0	8·2±	4·4	9·4	7·8	7·0	,, much worn.
C. mimula iculisma.											
France: Lignières-Sonneville, Charente	Gi. 191 Mottaz		16·2	5·0	3·8	7·8	4·0	9·0	7·4	7·0	,, not worn.
,, ,, ,,	Gi. 202 ,,		16·0	5·0	4·0	8·0	4·0	8·8	7·2	6·6	,, slightly worn.
,, ,, ,,	1115* ,,	♀	16·0	—	—	7·9	4·2	8·8	7·3	6·6	From Mottaz.

* Type.

Adult male and female from Corfu, Greece: head and body, 74 and 75; tail, 44 and 44; hind foot, 11·8 and 11·4. For cranial measurements see Table, p. 96.

Specimens examined.—Thirty-seven, from the following localities:—

FRANCE: Abbeville, Somme, 1; Agay, Var, 2.

GERMANY: Marxheim, Bavaria, 2.

AUSTRIA-HUNGARY: Haida, Arva, Bohemia, 4; Hatszeg, Hunyad, Transylvania, 1; Tatra Mts., Hungary, 1.

ROUMANIA: Gageni, Prahova, 1; Bustenari, Prahova, 1.

BULGARIA: Sofia, 1 (Andersen); Varna, 1 (Andersen).

SWITZERLAND: Züberwangen, St. Gallen, 3 (U.S.N.M. and Mottaz); Untervatz, Grisons, 2; Faido, Ticino, 1; Santa Margherita, Ticino, 3 (Mottaz); Davesco, Ticino, 1 (U.S.N.M.); Lugano, Ticino, 2 (B.M. and Mottaz); Locarno, Ticino, 1.

ITALY: Porlezza, Como, 4 (Mottaz); Viareggio, Lucca, 2; Rome, 1.

GREECE: Corfu, 2.

1.	Abbeville, Somme, France.	Baillon Collection.	56. B.
2 ♂.	Agay, Var.	G. S. Miller (C).	8. 8. 4. 162–163.
♂.	Marxheim, Bavaria, Germany. (*Wolterstorff.*)	Lord Lilford (P).	8. 9. 8. 4.
♂, ♀.	Haida, Bohemia, Austria.	Lord Lilford (P).	8. 9. 8. 5–6.
♀.	Hatszeg, Hunyad, Transylvania, Hungary.	C. G. Danford (C & P).	3. 2. 2. 12.
1 al.	Tatra Mountains.	Dr. R. Collett (P).	91. 1. 21. 2.
♀.	Gageni, Prahova, Roumania. (*W. Dodson.*)	Lord Lilford (P).	4. 4. 6. 11.
♂.	Bustenari, Prahova, 840 m. (*W. Dodson.*)	Lord Lilford (P).	4. 4. 6. 12.
♀.	Faido, Ticino, Switzerland.	O. Thomas (C & P).	5. 8. 2. 18.
♂.	Locarno, Ticino.	O. Thomas (C & P).	5. 8. 2. 1.
♂, ♀.	Untervatz, Grisons. (*E. H. Zollikofer.*)	O. Thomas (P).	4. 4. 5. 21–22.
♀.	Lugano, Ticino. (*E. H. Zollikofer.*)	O. Thomas (P).	4. 4. 5. 57.
♀.	Viareggio, Lucca, 5 m. Italy.	O. Thomas (C & P).	5. 8. 2. 21.
♂.	Rome. (*Coli.*)	G. Barrett-Hamilton (P).	11. 1. 2. 97.
♂.	Corfu, 50 m. Greece. (*C. Mottaz.*)	J. I. S. Whitaker (P).	8. 10. 1. 8.

CROCIDURA MIMULA ICULISMA Mottaz.

1908. *Crocidura mimula iculisma* Mottaz, Bull. Soc. Zool. de Genève, I, p. 119, April 30, 1908. Type in Mottaz Collection.

1910. *Crocidura mimula iculisma* Trouessart, Faune Mamm. d'Europe, p. 47.

Type locality.—Lignières-Sonneville, Charente, France.

Geographical distribution.—Known from the type locality only.

Diagnosis.—Size as in *C. mimula mimula* or slightly smaller (hind foot, 10; condylobasal length of skull, 16); brain-case deep, nearly as in *C. russula.*

Measurements.—Type (from Mottaz): head and body, 60·5; tail, 38·5; hind foot, 10·2. For cranial measurements see Table, p. 97.

Specimens examined.—Three, all from the type locality (Mottaz).

Remarks.—While this race appears to be distinct from true *mimula*, the material seen is insufficient to form the basis of any final opinion as to its status.

Crocidura mimula cantabra Cabrera.

1908. *Crocidura cantabra* Cabrera, Bol. Real Soc. Españ. Hist. Nat., VIII, p. 239, May, 1908. Type in Madrid Museum.
1910. *Crocidura cantabra* Trouessart, Faune Mamm. d'Europe, p. 46.

Type locality.—Basque Provinces, Spain, exact locality not known.

Geographical distribution.—Basque Provinces, Spain.

Diagnosis.—Colour paler and more grey than in the other races; size small.

Measurements.—Type (from Cabrera): head and body, 55; tail, 24; hind foot, 10; ear, 6·5; upper tooth-row, 7·2. (Cranial dimensions not known.)

Remarks.—I have not seen this animal, but from the original description, as well as from information received from Mr. Cabrera, it appears to be paler than the typical form, to which it bears much the same relation as *C. russula pulchra* to true *russula*.

CROCIDURA RUSSULA Hermann.

(Synonymy under subspecies.)

Geographical distribution.—Central and southern Europe, from the Mediterranean coast to Holland and central Germany. Not found in the British Islands.

Diagnosis—Size rather large (among the European forms): hind foot, 11 to 14 mm.; condylobasal length of skull, 18 to 20·4 mm.; upper tooth-row, 8·2 to 9 mm.; tail rather short, its actual length 33 to 45 mm., its ratio to head and body varying from 45 to 55; skull with brain-case not noticeably depressed, its height always at least half greatest width and usually more; large upper premolar with antero-external cusp small, its height usually less than that of third unicuspid; colour of underparts not strongly contrasted with that of back, the line of demarcation along side vaguely defined.

External characters.—In external characters, aside from the relatively longer tail, *Crocidura russula* agrees with *C. leucodon*. Depth of fur at middle of back about 5 mm. in summer, 8 mm. in winter.

Colour.—Upper parts varying from a dark hair-brown, tinged with bister to a light drab with or without a shade of wood-brown, the darker colour more frequent in winter pelage, the light apparently peculiar to summer. The pelage has the usual metallic gloss, and the individual hairs show strong silvery reflections in certain lights, particularly in the long full winter coat. Underparts usually a dull buffy grey or ecru-drab, but sometimes almost whitish, rarely tinged with a bright yellowish brown,* never strongly constrasted with back, the line of demarcation along sides always vague. Feet dull buffy grey or light drab Tail obscurely bicolor, like back above, like belly below.

Skull and teeth.—The skull resembles that of *Crocidura leucodon*, except that the brain-case is noticeably less flattened, its depth at middle always exceeding one half greatest width, a character readily appreciable to the eye when skulls of the two animals are viewed from behind. Teeth essentially as in the related species, but large upper premolar with antero-external

FIG. 20.

Posterior view of skull of *Crocidura leucodon* (upper figure), and *C. russula* (lower figure). × 1½.

FIG. 21.

Crocidura russula. Anterior teeth in profile. × 5.

cusp (paracone) low, its height often much less than that of third unicuspid, the distance from its point to ill-defined angle in cingulum over anterior root of tooth about half length of anterior border of main cusp: posterior cutting blade not so high as in *Crocidura leucodon*, the angle formed between its edge and conspicuously projecting point of main cusp well defined and less obtuse than in the related species.

Measurements.—In the different races the head and body ranges from 64 to 95 mm., tail from 33 to 46 mm., hind foot from 10·8 to 14 mm., condylobasal length of skull from 18 to 20·4 mm. The unusual apparent variability in length of head and body is probably in great part due to differences in method of taking the measurement and to differences in the condition of the specimens measured.

* Such specimens evidently formed the basis of Savi's *Sorex thoracicus* and Dehne's *S. chrysothorax*.

Crocidura russula russula Hermann.

1777. *Sorex araneus* Schreber, Säugthiere, III, p. 573 (not of Linnæus, 1758).
1780. *Sorex russulus* Hermann in Zimmermann, Geogr. Gesch., II, p. 382 (vicinity of Strassburg, Germany).
1780. ?? *Sorex constrictus* Hermann in Zimmermann, Geogr. Gesch., II, p. 383 (vicinity of Strassburg, Germany). Based on young in nest.
1792. ?? *Sorex unicolor* Kerr, Anim. Kingd., p. 208 (Strassburg, Germany. Based on Pennant's account of *Sorex constrictus*).
1798. *Sorex musaraneus* Cuvier, Tabl. Élém. de l'Hist. Nat. des Anim., p. 109 (France).
1800. ?? *Sorex leucurus* Shaw, Gen. Zool., I, pt. 2, p. 538 (Strassburg, Germany. Based on Schreber, pl. CLIXc, *S. constrictus* Hermann).
1801. *S[orex] a[raneus] cinereus* Bechstein, Gemeinn. Naturgesch. Deutschlands, I, 2nd ed., p. 867, misprinted 863 (Thüringen, Germany).
1801. *S[orex] a[raneus] candidus* Bechstein, Gemeinn. Naturgesch. Deutschlands, I, 2nd ed., p. 867, misprinted 863 (Thüringen, Germany).
1832. *Sorex fimbriatus* Wagler, Isis, p. 54 (Bavaria, Germany).
1832. *Croc[idura] moschata* Wagler, Isis, p. 275 (Substitute for *Sorex fimbriatus*).
1832. *C[rocidura] major* Wagler, Isis, p. 1218 (Bavaria, Germany).
1832. *Crocidura rufa* Wagler, Isis, p. 1218 (banks of the Rhine, Germany).
1832. *Crocidura poliogaster* Wagler, Isis, p. 1218 (banks of the Rhine, Germany).
1832. *Sorex thoracicus* Savi, Nuovo Giorn. de' Letterati, Pisa, XXIV, p. 52 (near Pisa, Italy).
1839. ? *Sorex inodorus* de Sélys-Longchamps, Études de Micromamm., p. 34 (Savi cited as authority, but name apparently published here for the first time as synonym of *aranea* (= *russula*)).
1839. ? [*Crocidura aranea*] var. *minor* de Sélys-Longchamps, Études de Micromamm., p. 35 (Silesia).
1839. [*Crocidura aranea*] var. *albiventris* de Sélys-Longchamps, Études de Micromamm., p. 36. (No locality given.)
1839. ? *Crocidura hydruntina* Costa, Fauna del Regno di Napoli, Mamm., p. 6 (Otranto, Calabria, Italy).
1855. *Sorex chrysothorax* Dehne, Allg. deutsche Naturhist. Zeitung, Neue Folge, I, p. 241 (Wilsdurf, near Dresden, Germany).
1857. *Crocidura araneus* Blasius, Säugethiere, Deutschlands, p. 144.
1895. *Crocidura russula* Thomas, The Zoologist, 3rd ser., XIX, p. 63, February, 1895.
1910. *Crocidura russula* Trouessart, Faune Mamm. d'Europe, p. 43.

Type locality.—Vicinity of Strassburg, Germany.

Geographical distribution.—Central Europe, from Holland and central Germany to the valley of the Garonne and the coast of south-eastern France (Var); Italy; Sardinia?*; Guernsey and Alderney, Channel Islands.

Diagnosis.—Size rather large (hind foot, 11·7 to 14, condylobasal length of skull, 19 to 20·4), and colour usually dark, seldom, if ever, becoming a light drab except in rather worn summer pelage.

Measurements.—Average and extremes of four specimens from Oosterbeek, Guelderland, Holland: head and body, 78 (76–81); tail, 41 (37–45); hind foot, 12·8 (12·2–13·9). Average and

* I have seen five Sardinian specimens in the Genoa Museum resembling the typical form of *Crocidura russula* and differing widely from the Corsican *C. cyrnensis* (see pp. 111–112).

extremes of nine specimens from Esneux, Liége, Belgium: head and body, 77 (72–85); tail, 35·6 (33–38); hind foot, 12·4 (11·7–13). Average of ten specimens from Pas-de-Calais, France: head and body, 74·5 (71–80); tail, 40·9 (38–46); hind foot, 13·1 (12·5–13·5). Average and extremes of six specimens from St. Cergues, Vaud, Switzerland: head and body, 87 (83–95); tail, 38·1 (35–41); hind foot, 12·8 (12·4–13·2). For cranial measurements see Table, p. 104.

Specimens examined.—One hundred and two, from the following localities:—

HOLLAND: Oosterbeek, Guelderland, 4.

BELGIUM: Esneux, Liége, 9; Waremme, Liége, 8 (U.S.N.M.); no exact locality, 1.

FRANCE: Boulogne-sur-Mer, Pas-de-Calais, 8; Guines, Pas-de-Calais, 2; Abbeville, Somme, 2 (B.M. and Mottaz); Guernsey, Channel Islands, 4; Alderney, Channel Islands, 1; St. Briac, Brittany, 1; Lignières, Charente, 1 (Mottaz); Nancy, Meurthe-et-Moselle, 1 (Merriam); Étupes, Doubs, 9 (Mottaz); Montauban, Haute-Savoie, 4; Valescure, Var, 2; Ax-les-Thermes, Ariège, 1; Luchon, Haute-Garonne, 2.

GERMANY: Ummerstadt, Thüringen, 2; Ingelheim, Rheinhessen, 2; Strassburg, 1.

SWITZERLAND: Geneva, 10 (U.S.N.M. and Mottaz); St. Cergues, Vaud, 9 (U.S.N.M. and Mottaz); Grosjean, Vaud, 1 (Mottaz); Chesières, Vaud, 1 (Mottaz); Lucerne, 1; Vitznau, Lake of Lucerne, 3; Thurgau, Roggwil, 1; St. Gallen, 3 (U.S.N.M.); Züberwangen, St. Gallen, 5 (B.M. and U.S.N.M.); Degersheim, St. Gallen, 5 (B.M. and U.S.N.M.); Engelberg, Unterwalden, 1.

ITALY: Ceresole d'Alba, Turin, 2 (Turin).

3 ♂, 1 ♀.	Oosterbeek, Guelderland, 50 m. Holland.	O. Thomas (C & P).	98. 2. 1. 9–12.
♂, ♀.	Oosterbeek, Guelderland. (*O. Thomas.*)	Miller Collection.	7. 7. 7. 3851–3852.
4 ♂, 4 ♀, 1.	Esneux, Liége, Belgium.	Lord Lilford (P).	95. 1. 1. 3–11.
1.	Belgium. (*H. Grönvold.*)	Tomes Collection.	7. 1. 1. 30.
2 ♂, ♀, 1.	Guernsey, Channel Islands. (*R. H. Bunting.*)	O. Thomas (P).	8. 9. 2. 18–21.
♀.	Alderney.	W. Eagle Clarke (P).	9. 3. 28. 1.
5 ♂, 3 ♀.	Boulogne, Pas-de-Calais, 10 m. France.	O. Thomas (C & P).	98. 1. 9. 4–11.
2 ♂.	Guines, Pas-de-Calais.	O. Thomas (C & P).	94. 6. 6. 8–9.
1.	Abbeville, Somme.	Baillon Collection.	56. A.
1.	St. Briac, Brittany.	W. M. Daly (C & P).	94. 10. 3. 1.
2.	Montauban, Haute-Savoie.	A. Robert (C & P).	97. 1. 9. 2–3.
2 ♂.	Montauban, Haute-Savoie, 900 m. (*A. Robert.*)	O. Thomas (P).	6. 4. 2. 2–3.
♂, ♀.	Valescure, Var.	G. S. Miller (C).	8. 8. 4. 164–165.
♀.	Ax-les-Thermes, Ariège.	V. Builles (C & P).	8. 3. 27. 1.
2 ♀.	Luchon, Haute-Garonne, 600 m. (*A. Robert.*)	O. Thomas (P).	6. 4. 1. 19–20.
2.	Ingelheim, Rheinhessen, Germany.	C. Hilgert (C).	8. 11. 2. 9–10.
♀.	Strassburg, Alsace. (*C. Mottaz.*)	O. Thomas (P).	8. 8. 10. 43.
3 ♀.	Vitznau, Lake of Lucerne, 500 m. Switzerland.	O. Thomas (C & P).	5. 8. 3. 9–11.
1 al.	Engelberg, 3300 ft. Switzerland.	Dr. J. Anderson (P).	99. 7. 17. 1.

Crocidura russula pulchra Cabrera.

1907. *Crocidura russula pulchra* Cabrera, Ann. and Mag. Nat. Hist., 7th ser., xx, p. 213, September 1, 1907. Type in Cabrera collection.

1907. *Crocidura russula pulchra* Cabrera, Bol. Real Soc. Espaň. Hist. Nat., Madrid, vii, p. 223, October, 1907. (For date see Cabrera, Ann. and Mag. Nat. Hist., 8th ser., i, p. 189, February, 1908.)

1910. *Crocidura russula pulchra* Trouessart, Faune Mamm. d'Europe, p. 45.

Type locality.—Valencia, Spain.

Geographical distribution.—Central and southern Spain; lowlands of France south of the Gironde.

Diagnosis.—Smaller than *Crocidura russula russula* (hind foot, 10·8 to 13, condylobasal length of skull, 18 to 19·4), and paler in colour, the back a light drab brown tinged with sepia or dull russet.

Measurements.—External measurements of type, male (from Cabrera): head and body, 71; tail, 41·5; hind foot, 12. Average and extremes of seven specimens from Silos, Burgos, Spain: head and body, 72·7 (67–78); tail, 36 (34–37); hind foot, 11·9 (10·8–12·4). Average and extremes of seven specimens from Granada, Spain: head and body, 69·6 (68–74); tail, 38·2 (36–40); hind foot, 12·2 (12–12·8). Average and extremes of ten specimens from Cadillac-sur-Garonne, Gironde, France: head and body, 75·2 (70–81); tail, 37 (33–40); hind foot, 11·6 (11–12). For cranial measurements see Table, p. 106.

Specimens examined.—Sixty-five, from the following localities:—

France: Cadillac-sur-Garonne, Gironde, 19 (U.S.N.M.); Montréjeau, Haute-Garonne, 3 (U.S.N.M.); St. Genies, near Nîmes, Gard, 2.*

Spain: Silos, Burgos, 18; Dehesa de Valencia, Valencia, 1; Alcoy, Alicante, 8; Elche, Alicante, 2; Venta del Baul, Granada, 2; Granada, 8; Barracas, Castellon, 1.

Portugal: Sierra de Gerez, 1 (in alcohol; perhaps referable to *cintræ*).

♀.	St. Genies, Gard, 102 m. France. (*C. Mottaz.*)	O. Thomas (p).	8. 8. 10. 42.
4 ♂.	Silos, Burgos, 980 m. Spain.	G. S. Miller (c).	8. 8. 4. 38–41.
♀.	Dehesa de Valencia. (*N. Gonzalez.*)	O. Thomas (p).	8. 2. 9. 46.
2 ♂, 1 ♀.	Alcoy, Alicante. (*N. Gonzalez.*)	O. Thomas (p).	8. 2. 9. 43–45.
♂, ♀.	Venta del Baul, Granada.	G. S. Miller (c).	8. 8. 4. 31–32.
4 ♂, 1 ♀.	Granada.	G. S. Miller (c).	8. 8. 4. 33–37.
♂ al.	Sierra de Gerez, Portugal.	Dr. H. Gadow (c & p).	87. 3. 28. 1.

* Intermediate between *pulchra* and true *russula*.

CRANIAL MEASUREMENTS OF *CROCIDURA RUSSULA*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case (median).	Mandible.	Maxillary tooth-row (entire).	Mandibular tooth-row (entire).	Observations.
C. russula russula.											
Holland: Oosterbeek	98. 2. 1. 11	♂	19·0	6·4	4·6	9·0	5·0	10·0	9·0	8·2	Teeth slightly worn.
,,	98. 2. 1. 12	♀	19·0	6·0	4·4	9·0	4·8	10·0	8·8	7·8	,, ,,
Belgium: Esneux	95. 1. 1. 3	♂	19·4	6·4	4·6	9·0	4·8	11·0	9·0	8·4	,, ,,
,,	95. 1. 1. 4	♂	20·4	6·8	4·6	9·6	5·0	11·2	9·0	8·6	,, not worn.
,,	95. 1. 1. 5	♂	19·0	6·6	4·6	9·0	5·0	10·8	9·0	8·4	,, slightly worn.
,,	95. 1. 1. 6	♂	20·4	7·0	4·6	9·6	5·0	11·4	9·0	8·6	,, ,,
,,	95. 1. 1. 10	♀	19·6	6·8	4·6	9·0	4·8	10·8	9·0	8·6	,, not worn.
,,	95. 1. 1. 11	♀	19·6	6·6	4·8	9·2	4·8	11·0	9·0	8·4	,, ,,
,,	95. 1. 1. 8	♀	19·6	6·6	4·6	9·4	4·8	11·0	9·2	8·4	,, ,,
,,	95. 1. 1. 9	♀	19·8	7·0	4·8	9·4	5·0	11·0	9·2	8·4	,, ,,
Waremme	86052	♂	19·2	6·4	4·2	9·2	4·8	10·8	8·8	8·2	,, slightly worn.
,,	86054	♂	20·0	6·4	4·2	9·4	5·0	11·0	9·0	8·2	,, ,,
,,	86056	♂	19·6	6·4	4·2	9·0	4·8	10·6	9·0	8·2	,, ,,
,,	86058	♂	19·4	6·4	4·4	9·2	4·8	10·8	9·0	8·0	,, not worn.
,,	86059	♂	20·2	6·6	4·4	9·2	4·8	11·2	9·2	8·4	,, slightly worn.
,,	86051	♀	19·6	6·4	4·2	9·4	4·8	11.0	9·2	8·2	,, ,,
,,	86055	♀	19·2	6·4	4·4	9·0	4·8	10·4	8·8	8·0	,, moderately worn.
,,	86060	♀	19·4	6·4	4·2	9·2	5·0	10·8	9·0	8·0	,, slightly worn.
France: near Boulogne, Pas-de-Calais	98. 1. 9. 4	♂	19·8	6·8	4·6	9·2	5·0	10·0	9·0	8·4	,, much worn.

France: near Boulogne, Pas-de-Calais	98. 1. 9. 5	♂	20·0	6·8	4·8	9·4	5·0	10·8	9·0	8·4	Teeth not worn.
,, ,, ,,	98. 1. 9. 6	♂	19·4	6·6	4·4	9·0	5·0	10·6	9·0	8·4	,, slightly worn.
,, ,, ,,	98. 1. 9. 7	♂	20·0	7·0	4·8	9·4	5·0	11·0	9·0	8·6	,, moderately worn.
,, ,, ,,	98. 1. 9. 8	♂	18·0	6·4	4·4	9·0	5·0	10·0	8·6	8·0	,, not worn.
,, ,, ,,	98. 1. 9. 9	♀	20·0	6·6	4·2	9·0	5·0	11·0	9·0	8·2	,, ,,
,, ,, ,,	98. 1. 9. 10	♀	—	6·4	4·0	—	—	11·2	9·0	8·4	,, ,,
,, ,, ,,	98. 1. 9. 11	♀	19·6	7·0	4·4	9·2	5·0	11·0	9·0	8·0	,, much worn.
St. Martin's, Guernsey	8. 9. 2. 19		18·2	6·2	4·0	9·0	4·8	9·6	8·4	7·6	,, slightly worn.
,, ,,	8. 9. 2. 18	♂	19·2	7·0	4·2	9·4	5·0	10·6	8·6	7·8	,, moderately worn.
,, ,,	8. 9. 2. 21	♂	19·0	6·8	4·2	9·0	4·8	10·6	8·6	7·6	,, ,,
,, ,,	152485	♂	18·8	6·6	4·0	8·8	4·6	10·0	8·8	8·0	,, slightly worn.
Ax-les-Thermes, Ariège	8. 3. 27. 1	♀	19·6	6·2	4·2	9·2	5·0	10·4	9·0	8·2	,, ,,
Nîmes, Gard	8. 8. 10. 42	♀	19·2	6·2	4·2	—	—	11·0	9·0	8·2	,, moderately worn.
,, ,,	152492		20·0	6·4	4·4	9·0	5·0	11·0	9·0	8·2	,, ,,
Valescure, Var	8. 8. 4. 164	♂	19·6	6·6	4·6	9·6	5·0	11·0	8·8	8·2	,, ,,
,, ,,	8. 8. 4. 165	♀	—	6·4	4·2	9·4	5±	10·8	8·8	8·0	,, ,,
Montauban, Haute-Savoie	97. 1. 9. 2		20·2	6·4	4·6	9·2	5·0	11·2	9·0	8·4	,, not worn.
,, ,,	97. 1. 9. 3		19·0	6·4	4·0	9·0	4·8	10·4	9·0	8·0	,, ,,
,, ,,	6. 4. 2. 2	♂	19·4	6·2	4·2	9·0	4·8	10·8	9·0	8·2	,, ,,
Germany: Strassburg	8. 8. 10. 43	♀	19·2	6·8	4·4	9·0	4·8	10·8	9·0	8·2	,, slightly worn.
Switzerland: St. Cergues, Vaud	124469	♂	19·6	6·2	4·2	9·2	4·8	10·6	8·6	8·0	,, ,,
,, ,,	124470	♂	19·2	6·2	4·2	9·2	4·8	10·6	9·0	8·2	,, not worn.
,, ,,	124471	♂	19·2	6·2	4·2	9·2	4·8	10·8	8·8	8·0	,, moderately worn.
,, ,,	124472	♀	19·2	6·2	4·2	9·2	4·8	10·6	8·8	8·0	,, not worn.
St. Gallen	86498	♀	19·6	6·6	4·4	9·4	5·0	10·6	8·8	8·2	,, moderately worn.
Züberwangen, St. Gallen	273 Mottaz	♂	20·0	7·0	4·6	9·4	5·0	11·2	9·0	8·2	,, slightly worn.

CRANIAL MEASUREMENTS OF *CROCIDURA RUSSULA—continued.*

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case (median).	Mandible.	Maxillary tooth-row (entire).	Mandibular tooth-row (entire).	Observations.
C. russula russula (*continued*).											
Switzerland: Züberwangen, St. Gallen	1417 Mottaz	♀	20·2	6·8	4·6	9·4	4·8	11·0	8·8	7·8	
Degersheim	123570	♀	19·6	6·6	4·6	9·2	4·8	11·0	9·0	8·2	Teeth slightly worn.
,,	123571	♂	19·6	6·6	4·6	9·2	4·8	11·0	8·8	8·0	,, moderately worn.
Lugano, Ticino	275 Mottaz	♀	19·8	6·4	4·6	9·0	4·6	10·4	8·6	8·0	,, ,,
,, ,,	1612 ,,	♀	20·0	6·4	4·4	9·0	4·8	11·0	9·0	8·2	,, not worn.
Italy: Ceresole d'Alba	Turin Museum	♀	19·0	6·2	4·2	—	—	11·0	9·0	8·2	,, ,,
Pisa	Ta. 220 Mottaz	♀	19·2	6·4	4·6	9±	4·8±	10·4	9·0	8·2	
C. russula pulchra.											
Spain: Silos, Burgos	8. 8. 4. 38	♂	18·0	6·0	4·2	9·0	4·8	10·0	8·4	7·8	Teeth moderately worn.
,, ,,	172115	♂	18·8	6·0	4·2	8·8	4·8	10·4	8·8	8·0	,, ,,
,, ,,	8. 8. 4. 39	♂	18·0	6·0	4·2	8·8	5·0	9·6	8·2	7·8	,, not worn.
,, ,,	8. 8. 4. 40	♂	19·0	6·2	4·0	9·0	4·8	10·0	8·6	8·0	,, slightly worn.
,, ,,	8. 8. 4. 41	♂	19·4	6·4	4·0	9·0	4·8	10·2	8·6	8·0	,, much worn.
,, ,,	8. 8. 4. 42	♀	19·0	6·2	4·2	8·8	5·0	10·6	8·8	8·0	,, slightly worn.
,, ,,	172114	♀	19·0	6·2	4·2	9·0	5·0	10·6	8·6	8·0	,, moderately worn.
,, ,,	8. 7. 7. 44	juv.	18·4	6·0	4·0	8·4	4·4	10·0	8·8	8·0	,, not worn.

Spain: Granada, Granada . .	8. 8. 4. 34	♂	18·8	6·4	4·2	9·0	4·8	10·4	8·4	7·8	Teeth moderately worn.
,, ,, . .	8. 8. 4. 35	♂	—	6·6	4·2	—	—	10·8	8·6	8·0	,, ,,
,, ,, . .	8. 8. 4. 36	♂	19·0	6·6	4·0	9·0	4·8	10·2	8·4	7·8	,, ,,
,, ,, . .	172116	♂	18·4	6·4	4·4	9·0	4·8	10·4	8·4	7·8	,, ,,
,, ,, . .	8. 8. 4. 37	♀	—	6·2	—	8·8	4·8	9·6	—	—	,, much worn.
Venta del Baul, Granada .	8. 8. 4. 31	♂	19·0	6·4	4·0	8·8	4·6	10·0	8·4	7·8	,, slightly worn
,, ,, .	8. 8. 4. 32	♀	19·0	6·4	4·0	9·0	4·8	10·4	8·8	8·0	,, ,,
Alcoy, Alicante . . .	8. 2. 9. 44	♀	19·0	6·2	4·0	8·8	4·6	10·4	8·6	8·0	,, ,,
Dehesa de Valencia, Valencia	8. 2. 9. 46	♀	19·2	6·4	4·2	8·8	4·6	10·2	8·8	8·2	,, ,,
France: Cadillac-sur-Garonne, Gironde	86960	♂	18·6	6·4	4·2	9·0	4·8	10·8	8·8	8·0	,, ,,
,, ,,	66964	♂	18·8	6·2	4·2	9·0	4·6	10·6	9·0	8·0	,, ,,
,, ,,	86966	♂	18·8	6·4	4·2	9·0	4·8	—	8·6	—	,, ,,
,, ,,	86969	♂	19·0	6·6	4·0	9·0	4·8	10·4	8·6	8·0	,, ,,
,, ,,	86970	♂	18·0	6·2	4·2	8·8	4·8	10·2	8·4	8·0	,, ,,
,, ,,	86958	♀	18·8	6·2	4·0	8·8	4·8	10·2	8·4	8·0	,, moderately worn.
,, ,,	86959	♀	18·6	6·2	4·2	9·0	4·8	10·0	8·6	8·0	,, slightly worn.
,, ,,	86962	♀	18·4	6·0	4·2	8·8	4·8	10·2	8·2	7·6	,, much worn.
,, ,,	86968	♀	18·4	6·2	4·0	9·0	4·6	10·4	8·6	8·0	,, not worn.
,, ,,	86974	♀	18·6	6·0	4·0	9·0	4·8	10·0	8·2	7·8	,, much worn.
C. russula cintræ.											
Portugal: Cintra	98. 2. 2. 10	♂	18·6	6·0	4·2	9·0	—	10·0	8·6	8·2	,, moderately worn.
,, ...	98. 2. 2. 11*	♂	18·0	6·2	4·4	9·0	4·8	10·2	8·6	8·0	,, ,,
,, ...	98. 2. 2. 12	♂	19·0	6·2	4·4	9·0	4·8	10·0	8·8	8·2	,, slightly worn.
,, ...	98. 2. 2. 13	♂	19·2	6·2	4·4	9·0	4·8	11·0	8·8	8·2	,, ,,
,, ...	98. 2. 2. 18	♀	—	6·2	4·2	—	—	10·2	8·8	8·2	,, moderately worn.

* Type.

Crocidura russula cintræ Miller.

1907. *Crocidura russula cintræ* Miller, Ann. and Mag. Nat. Hist., 7th ser., xx, p. 390, November, 1907. Type in British Museum.
1910. *Crocidura russula cintræ* Trouessart, Faune Mamm. d'Europe, p. 45.

Type locality.—Cintra, near Lisbon, Portugal.

Geographical distribution.—At present known only from the type locality.

Diagnosis.—Size as in *C. russula pulchra* (hind foot, 11·4 to 12·7, condylobasal length of skull, 18 to 19·2), but colour fully as dark as in true *russula*, the back between the mars-brown and russet of Ridgway, the hairs with a peculiar, strong, coppery lustre rarely indicated in the typical race.

Measurements.—External measurements of type: head and body, 64; tail, 33; hind foot, 11·4. Average and extremes of ten specimens from the type locality: head and body, 67·6 (64–72); tail, 37·7 (33–42); hind foot, 11·9 (11·4–12·7). For cranial measurements see Table, p. 107.

Specimens examined.—Eleven, all from the type locality.

Remarks.—In its small size the Cintra shrew agrees with the Spanish race, but the colour is conspicuously darker. Taken as a whole the series, in winter pelage, is about as dark as in French and Belgian *russula*; but the noticeable coppery lustre is highly characteristic of the Portuguese form.

6 ♂, 5 ♀.	Cintra, Estremadura, 300–350 m. Portugal.	O. Thomas (c & p).	98. 2. 2. 10–20. (*Type* of subspecies 98. 2. 2. 11.)

Crocidura sicula Miller.

1879. ? *Crocidura sicula* Giglioli, Wiegmann's Archiv für Naturgesch., 1879, i, p. 96. Nomen nudum: "*Crocidura sicula* (Giglioli MSS. sp. nov.?) Castelbuono, Sicilien."
1901. *Crocidura sicula* Miller, Proc. Biol. Soc., Washington, xiv, p. 41, April 25, 1901 (Palermo, Sicily). Type in U.S. National Museum.
1910. *Crocidura sicula* Trouessart, Faune Mamm. d'Europe, p. 47.

Type locality.—Palermo, Sicily.

Geographical distribution.—Sicily.

Diagnosis.—Size and colour essentially as in *Crocidura russula pulchra* (hind foot, 12 to 13 mm., condylobasal length of skull, 17·6 to 19 mm.); brain-case nearly as much flattened as in *C. leucodon*, its depth usually a little less than half greatest width; crown area of molars slightly reduced.

Colour.—Upper parts a light bluish drab tinged with sepia; underparts faintly constrasted pale smoke-grey, with or without a buffy cast. Feet dull whitish grey. Tail obscurely bicolor, brownish above, whitish grey below.

Skull and teeth. Except for its distinctly flattened brain-case

the skull resembles that of the small races of *Crocidura russula*. Teeth as in *C. russula*, but upper molars with crown area somewhat reduced, a character readily appreciable on comparison, and large upper premolar with antero-external cusp slightly enlarged, its form and relative size approaching the conditions found in *C. leucodon*.

Measurements. External measurements of type (male) and a second specimen from the type locality: head and body, 68 and 75; tail, 32 and 35; hind foot, 12 and 12. Average and extremes of six specimens from San Giuglielmo, Castelbuono, Sicily: head and body, 76·3 (72–80); tail, 35·3 (32–41); hind foot, 12·8 (12–13). For cranial measurements see Table, p. 113.

Specimens examined.—Fourteen, all from Sicily. Exact localities: Palermo, 5 (B.M. and U.S.N.M.); Marsala, 2; San Giuglielmo, Castelbuono, 6; Ficuzza, 1.

2 ♀.	Palermo, Sicily.	J. I. S. Whitaker (P).	98. 10. 6. 2–2*.
1.	Marsala. (*A. Robert.*)	O. Thomas (P).	6. 8. 4. 26.
3 ♂, 1 ♀.	San Giuglielmo, Castelbuono. (*A. Robert.*)	O. Thomas (P).	8. 9. 1. 6–9.

CROCIDURA CANEÆ Miller.

1909. *Crocidura caneæ* Miller, Ann. and Mag. Nat. Hist., 8th ser., III, p. 418, May, 1909. Type in British Museum.
1910. *Crocidura caneæ* Trouessart, Faune Mamm. d'Europe, p. 48.

Type locality.—Crete.

Geographical distribution.—Island of Crete.

Diagnosis.—Size and general appearance as in the smaller forms of *Crocidura russula*, and skull with similarly deep cranium: but second upper premolar as large as third, and entire anterior portion of upper tooth-row unusually long relatively to cheek-teeth.

Colour.—The colour does not differ appreciably from that of dark individuals of *C. russula*.

Skull.—The skull is essentially similar to that of the smaller forms of *Crocidura russula*. Brain-case slightly more than half as high as wide. Anterior portion of palate between unicuspids and anterior incisors more nearly parallel-sided, and more elongate than in any of the related species.

Teeth.—The teeth differ from those of all the other known European members of the genus in the approximately equal size of the two small upper unicuspids and in the longer, relatively narrower crown of the first unicuspid. In the related species the first unicuspid is so wide posteriorly that it makes an abrupt and noticeable break in the outline of outer side of tooth-row. In *C. caneæ* this tooth, though larger than usual, is not sufficiently wide to project beyond the general line of the outer margins of the unicuspid teeth. Second unicuspid fully as large as third, which is of normal size. The unicuspid row is thus distinctly

increased in length, so that the distance from front of large premolar to front of incisor equals that from front of large premolar to mesostyle of second molar, while in the related species it equals that from front of large premolar to metastyle of first molar. Large premolars and molars, particularly those of mandible, more robust than usual though not peculiar in form.

Measurements.—External measurements of type (male): head and body, 65; tail, 42; hind foot, 11·8. External measurements of adult male from Canea: head and body, 71; tail, 47; hind foot, 12·6; ear, 9·5. For cranial measurements see Table, p. 113.

Specimens examined.—Two, both from Crete.

♂ al.	Crete.	Purchased (Linnæa, Frankfort). (*Type* of species.)	84. 3. 14. 2.
♂.	Canea, Crete. (*C. H. B. Grant.*)	A. Trevor Battye (P).	8. 10. 24. 1.

CROCIDURA CAUDATA Miller.

1901. *Crocidura caudata* Miller, Proc. Biol. Soc. Washington, XIV, p. 42, April 25, 1901. Type in U.S. National Museum.
1910. *Crocidura caudata* Trouessart, Faune Mamm. d'Europe, p. 49.

Type locality.—Palermo, Sicily.

Geographical distribution.—Sicily.

Diagnosis.—Size about as in large specimens of *C. russula* (hind foot, 14 mm.). Tail very long, its ratio to head and body about 80, and so thickened that its diameter at middle is 3 mm. (in other European species the diameter of tail scarcely if at all exceeds 2 mm.).

External characters.—Except for the unusual length of the tail *Crocidura caudata* does not differ in external characters from *C. russula*. The tail is so long that when laid forward over back it extends to between ears. It is distinctly 4-sided, broader below than above, its greatest diameter at middle 3 mm.*

Colour.—After six months' immersion in alcohol the colour of the type specimen was essentially as in *Crocidura sicula*. After eight years more in the same fluid the back appears to have assumed a somewhat more brownish cast.

Skull and teeth.—The only known skull is so injured that the details of its form cannot be seen. The rostral portion does not differ appreciably from that of *C. russula*. Teeth essentially as in *C. russula*, but first upper unicuspid larger, third unicuspid more crowded against large premolar, and cutting edge of large premolar higher, its antero-external cusp, however, of the same form as in *C. russula*.

* In the type the tail is flattened laterally for about 13 mm. from tip, evidently as the result of an accident.

Measurements.—External measurements of type: head and body, 63; tail, 52; hind foot, 14. For cranial measurements see Table, p. 113.

Specimen examined.—The type.

Remarks.—The tail is actually as well as relatively longer in this species than in any other European member of the genus.

CROCIDURA CYRNENSIS Miller.

1907. *Crocidura cyrnensis* Miller, Ann. and Mag. Nat. Hist., 7th ser., xx, p. 390, November, 1907. Type in British Museum.
1910. *Crocidura cyrnensis* Trouessart, Faune Mamm. d'Europe, p. 49.

Type locality.—Bastia, Corsica.

Geographical distribution.—Corsica.

Diagnosis.—Smaller than *Crocidura caudata* (hind foot, 12 to 12·4 mm.) but with tail relatively almost as long, its ratio to head and body about 70.

External characters.—Similar to *C. caudata* except for the smaller size; tail apparently less thickened than in the Sicilian animal, its diameter at middle only about 2 mm.

Colour.—Back and sides drab washed with a brown intermediate between wood-brown and raw-umber, this especially noticeable on posterior half of back, but scarcely extending to sides, which are a nearly clear drab; underparts a light buffy drab-grey, inconspicuously contrasted with sides; tail dull dark drab, essentially unicolor; feet (both fore and hind) like tail on outer half, rather sharply contrasted pale buffy grey on inner half.

Skull and teeth.—While its general size and form are essentially as in *Crocidura russula*, the skull of the Corsican shrew is distinguishable by its broader, more deepened rostrum. In the type the mandible is peculiar in the unusual depth of ramus, though in a second specimen this character is less marked. Teeth essentially as in *C. russula*.

Measurements.—External measurements of type (adult male): head and body, 67; tail, 48; hind foot, 12·4. Very old female from the type locality: head and body, 62; tail, 46; hind foot, 12·4; ear, 8·2. External measurements of well made skin from La Foce de Vizzavona: head and body, 72; tail, 51; hind foot, 12. For cranial measurements see Table, p. 113.

Specimens examined.—Three, all from Corsica.

Remarks.—*Crocidura cyrnensis* is nearly related to *C. caudata*, though readily distinguishable by its smaller size and less thickened tail. So far as known it is the only shrew inhabiting Corsica. Whether an animal of this type occurs in Sardinia is a matter of doubt. Five Sardinian specimens (three from

Ovile Seardu and two from Zinnigas) in the Genoa museum appear to be strictly of the *russula* type, though without comparison of the skulls it is impossible to say whether they are most nearly related to true *russula* or to *sicula*. Their average and extreme measurements (from spirit specimens) are as follows: head and body, 65·2 (60–69); tail, 36·8 (33·6–39): hind foot, 12 (11·8–12·2).

1	La Foce de Vizzavona, Corsica.	Col. J. W. Yerbury (c & p).	93. 9. 15. 3.
♂ al.	Bastia, Corsica.	Mrs. Southwell (c & p). (*Type* of species.)	6. 3. 14. 1.
♀ al.	Bastia, Corsica.	Mrs. Southwell (c & p).	9. 6. 14. 1.

CROCIDURA BALEARICA Miller.

1901. *Crocidura russula* Thomas, Proc. Zool. Soc. London, p. 39.
1907. *Crocidura balearica* Miller, Ann. and Mag. Nat. Hist., 7th ser., xx, p. 391, November, 1907. Type in British Museum.
1910. *Crocidura balearica* Trouessart, Faune Mamm. d'Europe, p. 49.

Type locality.—San Cristobal, Minorca, Balearic Islands.

Geographical distribution.—Balearic Islands, Spain.

Diagnosis.—In general similar to *Crocidura cyrnensis*, but tooth-row distinctly shorter than in the Corsican form.

Colour.—The three skins are more noticeably brownish above than in the one skin of *cyrnensis* at present known, though the actual elements of the colour are the same. Feet with the same colour pattern.

Skull and teeth.—In cranial and dental characters the Balearic shrew agrees with *Crocidura cyrnensis*, except that the mandible is less robust (essentially as in the small races of *C. russula*) and the tooth-row is distinctly shorter. Brain-case somewhat more flattened than in the small races of *C. russula*.

Measurements.—External measurements of type (female): head and body, 62: tail, 45; hind foot, 12·5. External measurements of two other specimens from the type locality (male and female): head and body, 71 and 72; tail, — and 45; hind foot, 12·5 and 12. For cranial measurements see Table, p. 113.

Specimens examined.—Three, all from the type locality.

♂, 2 ♀	San Cristobal, Minorca; Balearic Islands.	O. Thomas and R. I. Pocock (c & p). (0. 7. 1. 42. *Type* of species.)	0. 7. 1. 40–42.

CRANIAL MEASUREMENTS OF *CROCIDURA SICULA*, *C. CANEÆ*, *C. CAUDATA*, *C. CYRNENSIS*, AND *C. BALEARICA*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case (median).	Mandible.	Maxillary tooth-row (entire).	Mandibular tooth-row (entire).	Observations.
C. sicula.											
Sicily: San Giuglielmo . .	8. 9. 1. 9		18·4	6·2	4·2	9·0	4·4	10·4	8·4	8·0	Teeth moderately worn.
,, ,, . .	152477	♀	—	6·4	4·2	—	—	10·8	8·8	8·0	,, slightly worn.
,, ,, . .	152478	♀	19·0	6·4	4·2	9·0	4·2	10·8	9·0	8·2	,, moderately worn.
,, ,, . .	8. 9. 1. 6	♂	18·6	6·2	4·2	9·0	4·2	10·0	8·4	7·6	,, much worn.
,, ,, . .	8. 9. 1. 7	♂	—	6·0	4·0	—	—	9·8	8·4	7·8	,, not worn.
,, ,, . .	8. 9. 1. 8	♂	—	6·6	4·2	—	—	10·2	8·4	7·8	,, moderately worn.
Palermo . . .	6. 8. 4. 26	♂	18·4	6·2	4·2	9·0	4·4	10·4	8·4	8·0	,, ,,
,, . . .	103300	♀	18·0	6·0	4·0	8·8	4·4	10·0	8·2	8·0	,, slightly worn.
,, . . .	103301*	♂	17·6	6·0	4·0	8·6	4·4	9·6	8·0	7·8	,, ,,
C. caneæ.											
Crete: No exact locality . .	84. 3. 14. 2*	♂	18·4	6·0	4·2	8·6	4·6	—	8·2	7·6	,, moderately worn.
Canea	8. 10. 24. 1	♂	—	6·0	4·0	—	—	10·2	8·2	7·6	,, ,,
C. caudata.											
Sicily: Palermo . . .	103302*	♂ juv.	18±	6·4	4·2	—	—	10·2	8·2	7·6	,, not worn.
C. cyrnensis.											
Corsica: La Foce di Vizzavona .	93. 9. 15. 3	?	18·8	6·0	4·6	9·0	—	10·2	8·8	8·0	,, slightly worn.
Bastia . . .	6. 3. 14. 1*	?	—	6·4	4·8	—	—	10·4	8+	7·4+	,, much worn.
,, . . .	9. 6. 14. 1	♀	18·6	6·2	—	9·0	4·6	10·0	8·2+	7·4+	,, ,,
C. balearica.											
Balearic Islands: San Cristobal, Minorca	0. 7. 1. 40	♂	18·4	6·2	4·2	8·8	4·8±	10·0	8·2	7·6	,, moderately worn.
,, ,,	0. 7. 1. 41	♀	—	6·0	4·2	9·0	—	10·0	8·0	7·4	,, slightly worn.

* Type.

Family ERINACEIDÆ.

1821. *Erinaceidæ* Gray, London Med. Repos., xv, p. 300, April 1, 1821.

Geographical distribution.—Tropical and temperate Africa, Europe and continental Asia; in Europe west to Ireland, north to central Sweden and south-eastern Norway.

Characters.—Skull deep and heavy, not specially tapering anteriorly, most of the sutures persistent; zygomatic arch complete and heavy; floor of brain-case completely ossified; tympanic bone annular, not attached to skull; auditory process of basisphenoid large, sometimes forming an evident half-bulla; glenoid surface directed downward (normal); a large external pterygoid plate; teeth anterior to molars neither well differentiated by form into incisors, canines and premolars nor strictly "unicuspid," the anterior upper incisor higher than the others but not specially modified in form; anterior lower incisor short, oblique; crowns of upper molars rather high, sub-quadrate in outline (except the reduced third), the cusps sub-equal, subterete, near margin of crown, the styles and commissures reduced or absent, never forming an important functional part of the tooth; form short and heavy; eyes and ears well developed; snout pointed, somewhat produced; back normally covered with short, stiff spines.

Remarks.—At present this family is usually regarded as containing the single genus *Erinaceus*. It is very probable, however, that several genera are represented among the members of the group.

Genus **ERINACEUS** Linnæus.

1758. *Erinaceus* Linnæus, Syst. Nat., i, 10th ed., p. 52 (*E. europæus*).
1857. *Erinaceus* Blasius, Säugethiere Deutschlands, p. 152.
1868. *Herinaceus* Mina-Palumbo, Ann. Agric. Sicil., 2nd ser., xii, p. 37.

Type species. *Erinaceus europæus* Linnæus.

Geographical distribution.—Essentially coincident with that of the family.

Characters.—Skull rather short and broad, the zygomatic breadth distinctly more than half greatest length; posterior palatal region conspicuously fenestrate; auditory process of basisphenoid well developed, concave, sometimes forming a half-bulla; external pterygoid plate rather larger than internal pterygoid plate, formed about equally of ectopterygoid and a broad horizontal outgrowth from palatine; dental formula: $i\ \frac{3-3}{2-2}$, $c\ \frac{1-1}{1-1}$, $pm\ \frac{3-3}{2-2}$, $m\ \frac{3-3}{3-3} = 36$; canines not differentiated by form from the contiguous teeth; third upper molar consisting of a large protocone and minute paracone, all trace of crushing surface absent; body short and heavy, the back covered with stiff, sharply pointed bristles of uniform length; tail shorter than hind foot.

Remarks.—About twenty-five species are currently referred to this genus, four of them occurring in Europe.

KEY TO THE EUROPEAN FORMS OF *ERINACEUS*.

Third upper incisor definitely 2-rooted; elevated portion of posterior lower premolar 2-cusped; a bare area among spines at middle of forehead (Spain, Balearic Islands and southern France)... *E. algirus*, p. 130.
Underparts clouded with brown, at least in interramial and intercrural regions (Spain and southern France)..... *E. a. algirus*, p. 131.
Underparts entirely whitish (Balearic Islands).... *E. a. vagans*, p. 133.
Third upper incisor never definitely 2-rooted; elevated portion of posterior lower premolar 3-cusped; no bare area among spines at middle of forehead.
Greatest upper length of maxillary greater than or at least equal to depth of rostrum at middle; anterior upper premolar sub-equal to canine, its posterior border with small though evident cusp (Eastern).
Hind foot 40 to 43 mm.; condylobasal length of skull in adult male about 58 mm. (Eastern Germany through Bohemia and Roumania to Greece)..... *E. roumanicus*, p. 127.
Hind foot 35 to 38 mm.; condylobasal length of skull in adult male about 55 mm. (Crete) *E. nesiotes*, p. 129.
Greatest upper length of maxillary less than depth of rostrum at middle; anterior upper premolar decidedly smaller than canine, its posterior border with cusp obsolete or absent (Western) ..... *E. europæus*, p. 115.
Size larger, the skull in old males exceeding 59 mm. in condylobasal length.
Average colour darker, the face never clear, pale, buffy grey, but usually with noticeable blackish markings (Central-western Europe)..... *E. e. europæus*, p. 120.
Average colour lighter, the face usually clear, pale, buffy grey without noticeable blackish markings (Iberian Peninsula)..... *E. e. hispanicus*, p. 122.
Size smaller, the skull in old males not exceeding 59 mm. in condylobasal length.
Colour of head and shoulders lighter than that of contiguous spiny area (Italy)..... *E. e. italicus*, p. 123.
Colour of head and shoulders darker than that of contiguous spiny area (Sicily)..... *E. e. consolei*, p. 126.

ERINACEUS EUROPÆUS Linnæus.

(Synonymy under subspecies.)

Geographical distribution.—Europe from the Mediterranean coast to Scotland and southern Scandinavia; west to Ireland; eastern limits of range not known.

Diagnosis.—Size large (head and body about 225 to 275; hind foot 40 mm. or more; condylobasal length of skull more than

55 mm.); spines coarse and heavy, extending in an unbroken line across forehead and decidedly overtopping ears; skull with heavy, deep rostrum, the distance from posterior extremity of premaxillary to posterior extremity of maxillary less than rostral depth at middle; auditory process of basisphenoid short, wide-funnel shaped, not forming a half-bulla; third upper incisor with one root, this sometimes partly divided longitudinally; elevated portion of posterior lower premolar with three cusps (fig. 25 *a*).

External characters.—General form short, thick and clumsy, the legs short, the feet large, plantigrade. Legs, tail, underparts and head, except crown, clothed with coarse fur, the finer more woolly hairs of which are about 15 mm. long, the longer, straight hairs about 40 mm. in length. The rest of the body is covered by a densely-set mass of sharply pointed bristles about 25 mm. in length and 1 mm. in diameter.* The skin on which these bristles are set is loosely attached to body, and provided with a special system of muscles by which the edges of the spiny area can be drawn together ventrally over the animal's retracted head and legs, forming a complete protection for the entire body. Feet robust with short digits and well developed claws, those on hind feet longest. Fore foot broad and rounded with very short, thick fingers, the third and fourth sub-equal and longest, second slightly shorter, fifth extending to base of fourth, first well developed but not reaching base of second; balls of all five large and pad-like; palm entirely naked; three large, semi-confluent pads at bases of median digits, a small tubercle (about 2 mm. in diameter) at base of thumb, and two large pads at back of wrist, the outer the larger; skin between pads wrinkled; hind foot much like fore foot but longer; second, third and fourth digits sub-equal and longest, but their claws noticeably graduated from second to fourth, fifth digit extending to base of fourth, first not reaching base of second; sole naked, the tubercles as on palm but more crowded, the two posterior sub-equal. Tail short and thick, its length much less than that of hind foot. Ear simple, rounded, shorter than bristles on crown, the meatus without valves. Muzzle moderately produced, somewhat pointed, the muzzle-pad well developed, naked, its surface marked with minute furrows, its lateral edges finely scalloped, its lower border continued as a pair of parallel ridges extending inward to palate. Eye well developed but rather small. Mammæ: p 1–1, a 2–2, i 2–2 = 10.

Colour.—Furred portions of body varying from dull brown to dirty whitish, the under fur usually a dusky hair-brown, the longer hairs lighter and more buffy. Belly often irregularly blotched and variegated with whitish and darker or lighter brown. Feet usually darker than sides. Cheeks and eye-ring often darker than rest of head. Spines buffy at base, then with

* Rarely the bristles are replaced by coarse hair like that on underparts. See Natural Science, XIII, p. 156, pl. II, September, 1898.

a slaty area of variable width, followed by a narrow but sharply defined buffy annulation and an obscurely darker tip. The general effect is a coarse grizzle, the exact tone of which varies considerably in the different geographical races as well as in individuals of the same race.

Skull.—General form of skull rather short, heavy and deep, the zygomatic breadth about $\frac{3}{4}$ upper length, the brain-case not

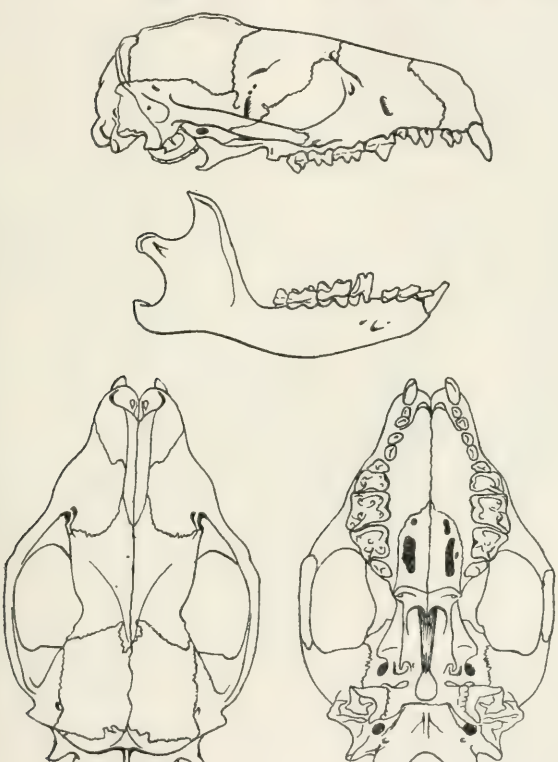

Fig. 22.
Erinaceus europæus. Nat. size.

conspicuously wider than interorbital region, the rostrum short and deep (distance from anteorbital foramen to front of premaxillary less than depth through anterior root of zygoma). Occiput and interorbital region marked by noticeable ridges.

Ventral profile straight, the dorsal profile essentially parallel to it from lambda nearly to front of interorbital region, then sloping forward at a slight angle (about 15°); occiput squarely or somewhat obliquely truncate. General outline of occipital region as viewed from behind truncate-triangular, slightly more than half as high as wide, the base of the triangle formed by line joining tips of widely projecting mastoid processes, the apex by the narrowly rounded or bluntly pointed lambdal region. Paroccipital processes nearly as large as mastoid processes and resembling them in form, though more slender and directed more backward. Basisphenoid with deep median pit between bases of half-funnel formed auditory processes, the pit continuous anteriorly with mesopterygoid fossa. Tympanic ring open postero-externally, its greatest breadth (antero-internal) about 3 mm. Inner and outer pterygoid plates broadly triangular, approximately alike in size and form, each containing more of the pterygoid than palatine element. Hamular short, strongly curved. Mesopterygoid space slightly longer than broad. Palate terminating posteriorly in a high transverse ridge and strongly projecting median spine, the ridge nearly straight, its median portion well developed. In front of ridge the palatine bones are conspicuously and irregularly fenestrate. Lambdoid crest high. Sagittal crest low but evident, extending forward to back of interorbital region. Here it divides into two low, diverging ridges which pass forward toward lachrymal region. In some specimens they can be traced as far as the high, well defined ridge which occupies edge of orbit for a distance of about 7 mm. above lachrymal foramen. Anteorbital foramen small, separated from lachrymal foramen by a space much greater than its own diameter, its anterior border over anterior root of large premolar. Upper portion of maxillary rather short, its length behind posterior point of premaxillary less than depth of rostrum at middle. Posterior termination of premaxillary variable in form: nearly square, broadly or narrowly cuneate, rounded, or rounded with supplemental inner spicule. Mandible short and heavy, the greatest depth of ramus about one-third length of alveolar line. Coronoid process high, narrow, sharply hooked backward at tip. Angular process about as wide as coronoid process, but not so long, its apex slightly bent inward.

Teeth.—General aspect of teeth as compared with that in other European members of the order, short, heavy and blunt, distinctly omnivorous rather than strictly insectivorous in type. Anterior upper incisor about twice as high as the succeeding small teeth, its shaft subterete, flattened posteriorly, directed slightly forward and inward, the teeth separated at base by space about equal to height of shaft, at tip by about half this distance. The four succeeding teeth (two incisors, canine and anterior premolar) are essentially alike in form, the crown slightly longer than wide, its height slightly greater than length,

the blunt point of conical cusp somewhat in front of middle of crown. Of these four unicuspid teeth the first is smallest, the second and third sub-equal and larger, the fourth intermediate. On posterior side of crown of each unicuspid there is a faintly developed ridge extending to apex of cusp, this ridge tending to rise posteriorly, especially in fourth unicuspid, to form a very rudimentary secondary cusplet. First and second incisors invariably single-rooted. Third incisor single-rooted, but root occasionally showing trace of longitudinal furrow on outer side. Canine usually single-rooted, the root with or without longitudinal furrow; but in a small series of specimens every stage may be observed from this condition to a completely two-rooted tooth, each root with a distinct alveolus. First premolar single-rooted, the root often showing traces of longitudinal division, and perhaps rarely double. Anterior lower incisor essentially like the corresponding upper tooth but not so high. Its shaft is directed obliquely forward in line with symphysis, the teeth of opposite sides parallel, separated throughout by a narrow space. Three succeeding teeth unicuspid, the crowns similar in outline to those of upper unicuspids, but anterior cusps obsolete and posterior cusplets relatively better developed. Second upper premolar scarcely broader than the unicuspids, but three-rooted and with a distinct protocone, metacone and postero-external commissure. Large upper premolar with well developed protocone, hypocone, metacone and postero-external commissure, the cusps much as in the molars except that hypocone is relatively smaller and metacone and its commissure larger and more trenchant. Large lower premolar with a high anterior three-cusped portion similar to first triangle of lower molars, except that the metaconid is reduced to a slight thickening at inner base of commissure of protoconid; second triangle represented by a mere narrow ledge or thickened cingulum. First upper molar sub-quadrate in outline, the crown slightly wider posteriorly than anteriorly. Protocone with somewhat broader base than the other cusps and with low ill-defined anterior and posterior commissures. Paracone, metacone and hypocone sub-equal, the metacone slightly larger than the others. All three are subterete with faintly indicated commissures, that extending outward and backward from metacone to rudimentary metastyle the most distinct. Parastyle and mesostyle

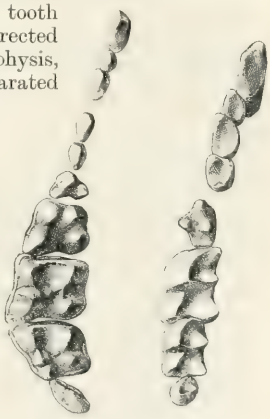

FIG. 23.

Erinaceus europæus. Teeth.

absent.* A small but evident metaconule. Second molar like first but smaller, its crown area about equal to that of large premolar, its greatest diameter anterior instead of posterior. Cusps essentially as in first molar, except that paracone is larger than metacone and hypocone, and metaconule is barely indicated. Third molar reduced to a protocone nearly as large as in the other teeth, and a rudimentary paracone, the two connected by a cutting edge sloping obliquely outward, forward and upward. The tooth is single-rooted. Lower molars with the usual cusps and commissures, the cusps more terete and commissures less trenchant than in other European insectivores. Third molar consisting of the anterior triangle only, this somewhat smaller than in the other two teeth.

ERINACEUS EUROPÆUS EUROPÆUS Linnæus.

1758. [*Erinaceus*] *europæus* Linnæus, Systema Naturæ, I, 10th ed., p. 52 (Sweden).
1779. [*Hystrix*] *erinaceus* Blumenbach, Handbuch d. Naturgesch., p. 72 (Germany).
1803. *Erinaceus suillus* Geoffroy, Catal. Mammif. du Mus. Nat. d'Hist. Nat., p. 67 (France).
1803. *Erinaceus caninus* Geoffroy, Catal. Mammif. du Mus. Nat. d'Hist. Nat., p. 68 (France).
1857. *Erinaceus europæus* Blasius, Säugethiere Deutschlands, p. 153 (part).
1858. *E*[*rinaceus*] *caniceps* Hamilton Smith, Jard. Nat. Libr., 2nd ed., XV (Mammalia I), p. 148 (near Brussels, Belgium).
1897. [*Erinaceus*] *echinus* Schulze, Abh. u. Vortr. Gesammtb. Naturw. IV, No. 10, p. 19 (Substitute for *europæus*).
1900. *Erinaceus europæus* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., V, p. 362, April, 1900.
1900. *Erinaceus europæus occidentalis* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., V, p. 362, April, 1900 (Haddingtonshire, Scotland). Type in British Museum.
1910. *Erinaceus europæus* and *E. europæus occidentalis* Trouessart, Faune Mamm. d'Europe, p. 38.

Type locality. Upsala, Sweden.

Geographical distribution.—Western central Europe from Scotland, southern Norway, and central Sweden to the Pyrenees and Alps; west to Ireland; eastern limits of range not known.

Diagnosis.—Size largest of the European hedgehogs (condylobasal length of fully adult skulls usually 61 to 63 mm., seldom less than 60 mm.); colour dark, the sides and underparts seldom if ever a light buffy grey; face with blackish area extending from eye to muzzle.

Measurements.—Adult male and female from Upsala, Sweden: head and body, 265 and 263; tail, 34 and 37; hind foot, 44 and 43. Adult male from Innerwick, Haddingtonshire, Scotland: head and body, 218; tail, 17; hind foot, 42. Adult male and

* The cingulum usually forms a small projection resembling a rudimentary parastyle.

female from Oundle, Northampton, England: head and body, 249 and 257; tail, 24 and 31; hind foot, 40 and 40. Adult male and female from Maredsous, Namur, Belgium: head and body, 270 and 251; tail, 39 and 33; hind foot, 44 and 44. Adult male from Bouconne, Gers, France: head and body, 220; tail, 20; hind foot, 41. Adult male and female from St. Gallen, Switzerland: head and body, 279 and 297; tail, 41 and 43; hind foot, 44 and 47. For cranial measurements see Table, p. 124.

Specimens examined.—Seventy-three, from the following localities:—

Scotland: Dunphail, Elgin, 2; Gordonstown, Elgin, 2; Innerwick, Haddingtonshire, 1; Glendoc, Inverness, 1 (Wilson); Lanarkshire, 1.

England: Kelnsea, Spurn, Yorkshire, 1; Leeds, Yorkshire, 1 (U.S.N.M.); Somersetshire, 4; Shrewsbury, Shropshire, 3; Oundle, Northampton, 2; Graftonbury, Herefordshire, 1; Saffron Walden, Essex, 2; Banstead, Surrey, 1; Elstead, near Godalming, Surrey, 1; Ockley, Surrey, 1; Wandsworth Common, Surrey, 1; Hampshire, 1 (U.S.N.M.).

Wales: Cardiff, 2.

Ireland: Castle Hamilton, 1; Nenagh, Tipperary, 2; Ennis, Co. Clare, 2; Glenmore, Co. Donegal, 1 (U.S.N.M.); Kilmanock, Wexford, 2.

Norway: Asker, near Christiania, 1.

Sweden: Upsala, 5 (U.S.N.M.); Upland, 1.

Denmark: Copenhagen, 5 (Andersen).

Holland: No exact locality, 1.

Belgium: Maredsous, Namur, 2.

France: Forêt de Bouconne, Gers, 1; Cranves-Sales, Haute-Savoie, 1.

Germany: Brunswick, 1 (U.S.N.M.); Heidelberg, 1 (U.S.N.M.); Strass, near Burgheim, Bavaria, 3; Ingelheim, Rheinhessen, 1.

Switzerland: Geneva, 2 (Mottaz); St. Gallen, 7 (B.M. and U.S.N.M.); Uzwil, St. Gallen, 1 (U.S.N.M.); Heresau, St. Gallen, 1 (U.S.N.M.); Wolfhalden, Appenzell, 1 (U.S.N.M.); Thurgau, 2.

Remarks.—The typical race of *Erinaceus europæus* is distinguishable from the forms occurring in the Mediterranean region by its combination of large size with dark colour. It is more readily confused with the dark *E. roumanicus*, whose range adjoins it on the east, and from which it cannot be distinguished with certainty except by comparison of the skull and teeth. The cranial character supposed to distinguish British specimens from the Continental form appears to be too inconstant to warrant the recognition of an insular race.*

♂, ♀.	Gordonstown, Elginshire, Scotland.	W. R. Ogilvie-Grant (c & p).	11. 1. 3. 379–380.
♂.	Innerwick, Haddingtonshire.	W. Eagle Clarke (c & p). (*Type* of *E. e. occidentalis* B.-Ham.)	0. 3. 13. 1.
♀.	Stockbriggs, Lanarkshire.	E. R. Alston (c & p).	79. 9. 25. 76.
♂, ♀.	Oundle, Northampton, England.	Hon. N. 'C. Rothschild (c & p).	11. 1. 3. 381–382.
♂.	Graftonbury, Herefordshire.	W. E. de Winton (c & p).	11. 1. 3. 383.

* For discussion of this character see Lönnberg, Ann. and Mag. Nat. Hist., 7th ser., v, pp. 542–544, June, 1900, and Barrett-Hamilton, l.c., pp. 245–246, August, 1900. The question cannot yet be regarded as decided, since no adequate series of skulls has yet been brought together.

2 ♂.	Saffron Walden, Essex. (*Wright.*)	G. Barrett-Hamilton (P).	11. 1. 2. 91–92.
♂.	Banstead, Surrey.	C. H. B. Grant (C & P).	11. 1. 3. 386.
♂.	Godalming, Surrey.	W. T. Blanford (C & P).	11. 1. 3. 384.
♂.	Ockley, Surrey.	Hon. Ella Scarlett (C & P).	11. 1. 3. 385.
3 juv.al.	Shrewsbury, Shropshire.	H. E. Forrest (C & P).	0. 9. 23. 1–3.
♂, ♀.	Somerset.	Dr. J. Anderson (P).	93. 7. 31. 1–2.
♂, ♀ al.	Somerset.	Dr. J. Anderson (P).	93. 7. 31. 3–4.
♀.	Cardiff, Glamorganshire, Wales.	R. Drane (C & P).	11. 1. 3. 387.
♂.	Nenagh, Tipperary, Ireland. (*W. Smithwick.*)	G. Barrett-Hamilton (P).	11. 1. 2. 95.
♂ al. ♂.	Ennis, Clare.	J. W. Scott (C & P).	93. 10. 30. 1–2.
2 ♂.	Kilmanock, Wexford.	G. Barrett-Hamilton (C & P).	11. 1. 2. 93–94.
1.	Asker, Christiania, Norway.	Christiania Museum (E).	93. 3. 1. 7.
♂ juv.	Upland, Sweden. (*G. Kolthoff.*)	Lord Lilford (P).	11. 1. 1. 151.
1 al.	Holland. (*Seba Coll.*)	Lidth de Jeude Coll.	67. 4. 12. 555.
2 ♂.	Maredsous, Namur, Belgium.	Rev. G. Fournier (C & P).	1. 6. 2. 1–2.
♂.	Forêt de Bouconne, Gers, 250 m. France. (*A. Robert.*)	O. Thomas (P).	6. 4. 1. 10.
♀.	Cranves - Sales, Haute-Savoie. (*A. Robert.*)	O. Thomas (P).	6. 4. 2. 1.
♂, ♀.	Burgheim, Bavaria, Germany. (*Wolterstorff.*)	Lord Lilford (P).	11. 1. 1. 92, 150.
♂.	Ingelheim, Rheinhessen.	C. Hilgert (C).	8. 11. 2. 5.
2 ♂, ♀ juv.	St. Gallen, 500 m. Switzerland. (*E. H. Zollikofer.*)	O. Thomas (P).	4. 4. 5. 27–29.
♂, ♀.	Thurgau, 400 m. (*E. H. Zollikofer.*)	O. Thomas (P).	4. 4. 5. 30–31.

Erinaceus europæus hispanicus Barrett-Hamilton.

1900. *Erinaceus europæus hispanicus* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., v, p. 363, April, 1900. Type in British Museum.

1910. *Erinaceus europæus hispanicus* Trouessart, Faune Mamm. d'Europe, p. 39.

Type locality.—Seville, Spain.

Geographical distribution.—Iberian Peninsula.

Diagnosis.—Size large, essentially as in *E. europæus europæus* (condylobasal length of skull in old individuals about 60 mm.); general colour paler than in the typical race, the fur often a uniform light buffy grey, seldom with any evident darker area between eye and muzzle.

Colour.—There is much variation in colour, some individuals essentially agreeing with the palest examples of true *europæus*. In its extreme phase, however, the colour is a whitish buff, decidedly paler than the cream-buff of Ridgway, the muzzle and region about eyes washed with ecru-drab; feet tinged with drab; spines the same whitish buff, about half of them with scarcely any

dark shading, the rest with a drab sub-terminal band, the general effect of spiny area scarcely speckled, and nearly as pale as fur. In the type specimen the fur is a dull cream-buff, and the feet are washed with broccoli-brown ; spines drab brown with light tips, essentially as in true *europæus*.

Measurements.—Type : hind foot (dry), 40. Adult male and female from Burgos, Spain : head and body, 270 and 250 ; tail, 30 and 28 ; hind foot, 43 and 41. Adult male and female from Pajáres, Leon : head and body, 252 and 249 ; tail, 22 and 21 ; hind foot, 44 and 42. For cranial measurements see Table, p. 125.

Specimens examined.—Twenty, from the following localities in Spain : Arrechavaleta, Vitoria, 1 ; Pajáres, Leon, 7 ; Burgos, 5 ; Palacios de la Sierra, Burgos, 1 ; Bejar, Salamanca, 2 ; Seville, 4.

Remarks.—The Spanish hedgehog is a moderately well differentiated form. Extreme specimens are easily distinguishable from typical *europæus ;* but in general the difference between the two races must be regarded as an average one.

♂.	Arrechavaleta, Vitoria, Spain. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 9.
♂, 2 ♀, ♀ juv.	Pajáres, Leon. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 2–6.
♂, ♀, ♀ juv.	Burgos.	G. S. Miller (C).	8. 8. 4. 17–19.
2 ♂.	Burgos. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 10–11.
2 ♂ juv.	Bejar, Salamanca. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 7–8.
♂, 2 ♀, 1.	Seville. (*Dr. A. Ruiz.*)	Lord Lilford (P).	95. 3. 3. 1–4. (*Type* of subspecies 95. 3. 3. 2.)

Erinaceus europæus italicus Barrett-Hamilton.

1857. *Erinaceus europæus* Blasius, Säugethiere Deutschlands, p. 153 (part).
1900. *Erinaceus europæus italicus* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., v, p. 364, April, 1900. Type in British Museum.
1910. *Erinaceus europæus italicus* Trouessart, Faune Mamm. d'Europe, p. 39.

Type locality.—Siena, Italy.

Geographical distribution.—Italian Switzerland, Italy and Sardinia ; Corsica ?

Diagnosis.—Colour as in *E. europæus europæus* or slightly paler ; size less than in the typical race, the largest skulls probably not exceeding 59 mm.

Colour.—The colour is about as in the paler individuals of typical *europæus*, though the speckling of the spiny area seems in general to be finer, and the underparts usually lack all heavy dark clouding.

Measurements.—Adult female from Curoggio, Ticino, Switzerland : head and body, 250 ; tail, 29 ; hind foot, 41. Two adult

CRANIAL MEASUREMENTS OF *ERINACEUS EUROPÆUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Mastoid breadth.	Postorbital constriction.	Breadth of rostrum at præmaxillary suture.	Palatal depth behind m^3 (lateral).	Mandible.	Maxillary tooth-row (entire: alveoli).	Mandibular tooth-row (entire: alveoli).	Observations.
E. europæus europæus.												
Norway: near Christiania	93. 3. 1. 7	♀	57·6±	35·2	28·0	15·2	12·6	19·0	44·0	28·0	23·4	Teeth slightly worn.
Sweden: Upsala	85087	♂	57·6	35·4	29·2	14·4	11·8	18·2	43·4	26·8	21·2	,, ,,
,,	85092	♂	58·6	36·8	29·4	14·8	12·0	18·0	43·8	27·8	22·6	,, ,,
,,	85086	♀	58·2	35·2	29·0	15·0	12·2	17·8	44·0	28·2	23·2	,, ,,
,,	85090	♀	59·0	37·2	30·0	14·6	12·4	18·4	45·6	28·0	23·4	,, ,,
,,	85091	♀	59·6	37·6	30·4	15·2	12·8	17·8	45·6	28·8	23·6	,, ,,
Denmark: Copenhagen	Andersen		58·8	37·4	30·0	14·6	12·8	18·8	43·8	28·8	23·6	,, much worn.
,,	,,		57·6	37·2	29·6	15·0	12·2	19·0	43·4	28·4	22·8	,, slightly worn.
Scotland: Haddingtonshire	0. 3. 13. 1*	♂	59·0	35·0	29·0	14·8	13·8	19·4	44·4	30·0	24·0	,, much worn.
Lanarkshire	79. 9. 25. 76	♀	56·8	35·0	29·2	13·8	13·6	18·0	43·0	29·0	23·0	,, slightly worn.
Wales: Cardiff	153409	♂	58·2	35·6	29·4	14·6	12·6	18·0	44·4	28·8	23·2	,, ,,
England: Wandsworth Common, Surrey	153410	♂	56·6	33·4	26·8	14·4	11·8	17·2	42·0	28·8	22·8	,, ,,
Ireland: Glenmore, Co. Donegal	86923	♀	59·2	35·4	29·2	15·0	12·4	18·2	43·8	29·2	22·8	,, ,,
Belgium: Maredsous, Namur	1. 6. 2. 1	♂	62·0	38·8	30·0	14·8	13·2	19·6	46·0	30·2	24·0	,, much worn.
,, ,,	1. 6. 2. 2	♂	58·4	37·0	28·2	14·6	12·4	18·8	45·0	30·0	24·2	,, moderately worn.
France: Bouconne, Gers	6. 4. 1. 10	♂	56·8	34·0	26·8	14·0	11·6	17·0	42·0	29·0	21·6	,, ,,
Germany: Brunswick	85619	♂	58·8	37·4	29·4	14·2	13·4	17·4	44·2	29 0	23·2	,, ,,
Ingelheim, Rheinhessen	8. 11. 2. 5	♂	58·8	35·8	29·2	14·6	12·0	17·2	44·2	29·2	23·6	,, ,,

Switzerland: St. Gallen . .	4. 4. 5. 29	♀	62·6	38·0	30·8	14·6	13·8	19·0	47·0	31·6	25·0	Teeth moderately worn.
,, . .	115197	♂	60·0	37·8	29·8	14·2	14·2	18·6	44·8	29·8	24·2	,, ,,
Wolfhalden . .	84740	♂	62·2	38·4	30·0	15·6	12·2	18·6	45·0	30·8	23·2	,, slightly worn.
Heresau . .	115198	♀	60·8	38·8	30·4	14·8	12·8	18·8	45·8	30·2	24·2	,, ,,
Geneva . .	710 Mottaz	♂	60·0	38·0	31·4	14·8	12·4	18·8	47·4	28·8	25·0	,, ,,
E. europæus italicus.												
Switzerland: Curoggio, Ticino .	115199	♀	56·2	34·2	27·8	14·2	12·0	17·0	42·6	27·6	22·4	,, moderately worn.
Italy: Siena	98. 10. 2. 6	♂	56·0	34·0	26·8	14·2	12·0	16·4	42·0	27·4	21·0	,, ,,
,, ...	98. 10. 2. 7	♀	55·0	36·4	27·8	14·6	11·6	17·4	—	27·0	—	,, slightly worn.
Ostia, Rome . .	1. 1. 2. 7	?	57·4	37·0	29·2	15·0	13·0	18·0	44·0	28·0	22·8	,, moderately worn.
Marusei, Lanusei, Sardinia	0. 12. 3. 6	♀	53·0	32·4	25·8	14·0	11·6	16·6	40·4	26·6	21·8	,, slightly worn.
E. europæus consolei.												
Italy: Palermo, Sicily . .	98. 10. 6. 1†		—	36·0	—	14·2	12·0	17·4	42·6	28·8	23·0	,, ,,
E. europæus hispanicus.												
Spain: Pajáres, Leon . .	8. 2. 9. 2	♂	60·0	36·0	29·0	14·8	12·0	19·0	44·6	30·8	24·0	,, much worn.
,, ,, . .	153415	♂	58·0	35·6	28·4	14·8	12·8	18·4	43·0	29·8	24·4	,, slightly worn.
,, ,, . .	8. 2. 9. 3	♀	59·6	36·0	29·4	15·0	12·0	17·6	45·0	31·0	24·8	,, moderately worn.
,, ,, . .	8. 2. 9. 4	♀	59·4	37·0	28·6	14·6	12·2	17·8	45·0	30·0	24·0	,, slightly worn.
,, ,, . .	153414	♀	60·0	38·0	31·0	14·8	13·0	19·2	46·0	30·0	25·0	,, ,,
,, ,, . .	8. 2. 9. 5	♀	59·0	37·8	29·8	15·0	12·0	18·0	44·6	29·0	23·8	,, much worn.
Burgos . . .	8. 8. 4. 18	♂	60·0	37·0	29·6	15·0	13·0	18·8	45·4	29·4	23·6	,, moderately worn.
,, ...	8. 8. 4. 19	♀	56·4	35·0	28·4	13·8	12·0	18·2	43·6	29·6	24·6	,, slightly worn.
Seville	95. 3. 3. 2†	?	59·4	37·6	29·0	15·0	13·2	18·4	43·6	29·8	23·4	,, much worn.
,, ...	95. 3. 3. 4	♀	57·4	36·8	28·4	—	12·4	—	43·4	29·0	23·2	,, ,,

* Type of *Erinaceus europæus occidentalis* Barrett-Hamilton.

† Type.

males from Siena, Italy: head and body, 210 and 220; * tail, 30 and 28; * hind foot, 40 and 42.* Two adult females from the same locality: head and body, 200 and 208; tail, — and 32; hind foot, 43 and 38. For cranial measurements see Table, p. 125.

Specimens examined.—Seventeen, from the following localities:—
Switzerland: Bigorio, Ticino, 1 (U.S.N.M.); Curoggio, Ticino, 1 (U.S.N.M.); Gentilino, Ticino, 1 (U.S.N.M.).
Italy: Empoli, Florence, 1; Siena, 4; Ostia, Rome, 1; Rome, 4.
Sardinia: Su Cramu, 1; Bare, 1; Marusei, 1; Trecorgia, 1.

Remarks.—Though not so pale as the Spanish race the Italian hedgehog seems worthy of recognition as a form distinct from true *europæus*. Its status is at present unsatisfactory, owing to the lack of sufficient material; but specimens from south of the Alps seem never to attain the large size of Central European adults. The Sardinian specimens that I have seen are in general paler than those from the mainland; but here again the material is insufficient. A hedgehog is known to occur in Corsica, but no specimens have yet been compared with the Italian race.

♀.	Empoli, Florence, Italy.	A. H. Savage Landor (C & P).	97. 3. 7. 1.
2 ♂, 2 ♀.	Siena. (*S. Brogi.*)	Dr. E. Hamilton (P).	98. 10. 2. 5–8. (*Type* of subspecies 98. 10. 2. 5.)
1.	Ostia, Rome.	Dr. L. Sambon (C & P).	1. 1. 2. 7.
3 ♂.	Rome. (*C. Coli.*)	G. Barrett-Hamilton (P).	11. 1. 2. 3–4. 96.
♂.	Su Cramu, Sardinia. (*W. Wolterstorff.*)	O. Thomas (P).	0. 12. 3. 5.
♂.	Bare. (*W. Wolterstorff.*)	O. Thomas (P).	0. 12. 3. 3.
♀.	Marusei. (*W. Wolterstorff.*)	O. Thomas (P).	0. 12. 3. 6.
♀ juv.	Trecorgia. (*W. Wolterstorff.*)	O. Thomas (P).	0. 12. 3. 4.

Erinaceus europæus consolei Barrett-Hamilton.

1900. *Erinaceus europæus consolei* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., v, p. 366, April, 1900. Type in British Museum.
1910. *Erinaceus europæus consolei* Trouessart, Faune Mamm. d'Europe, p. 40.

Type locality.—Palermo, Sicily.
Geographical distribution.—Sicily.
Diagnosis.—Size apparently as in *E. europæus italicus* (only known specimen imperfect); colour differing from that of *italicus* in the uniform dusky brown head and shoulders: quills unusually robust, their dark and light markings strikingly contrasted.
Colour.—Whole head and sides of neck and shoulders a uniform dark brown between hair-brown and sepia, sprinkled with buffy grey hairs. The dark brown continues back along

* Type.

edge of spiny area to tail, but throughout this region it is overlaid by the uniform light cream-buff of underparts. Spines very dark drab with light cream-buff tips, the light area shorter on spines of middle of back than on those of sides, thus producing a slight though evident darker median dorsal area. Feet so injured that colour cannot be determined.

Skull and teeth.—The imperfect skull shows no peculiarities. Teeth as in specimens from the mainland.

Measurements.—Type (sex not known) : head and body, 252 ; tail, 50 ; hind foot, 40. For cranial measurements see Table, p. 125.

Specimen examined.—The type.

Remarks.—If not an abnormal specimen of *E. europæus italicus* the type of *consolei* represents a very distinct local race.

1. Palermo, Sicily. J. I. S. Whitaker (P). 98. 10. 6. 1. (*Type* of subspecies.)

ERINACEUS ROUMANICUS Barrett-Hamilton.

1900. *Erinaceus europæus roumanicus* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., v, p. 365, April, 1900. (Gageni, Roumania.) Type in British Museum.

1901. *Erinaceus danubicus* Matschie, Sitz.-Ber. Gesellsch. Naturforsch. Freunde, Berlin, p. 229, December, 1901. (Prundu, Roumania.)

1910. *Erinaceus europæus roumanicus* and *E. europæus danubicus* Trouessart, Faune Mamm. d'Europe, pp. 40–41.

Type locality.—Gageni, Prahova, Roumania.

Geographical distribution.—From eastern Germany (Königsberg) and northern Bohemia south through Hungary, into Greece.

Diagnosis.—In general like *Erinaceus europæus*, but colour of furred parts usually much darker, and chest often with a large, conspicuously contrasted whitish area ; skull with upper length of maxillary greater than depth of rostrum at middle : teeth essentially as in *E. europæus*, but first upper premolar with postero-basal cusp usually more distinct.

Colour.—Furred area dark hair-brown interspersed with buffy and whitish hairs, the former most numerous on sides, the latter forming a clear whitish pectoral area which sometimes spreads over entire underparts. Feet and tail sepia. Face usually with a seal-brown suffusion. Claws blackish horn-colour. Quills with colours usually less contrasted than in *E. europæus*, the general effect of the spiny area darker and less speckled.

Skull and teeth. - The skull differs from that of *E. europæus* in the relatively longer, less deepened rostrum, a peculiarity which seems chiefly to involve the maxillary bone. Upper length of maxillary greater than depth of rostrum at middle. Posterior

transverse palatal ridge usually lower and less developed, particularly at middle, where there is often a slight angle. Ridge at margin of orbit in lachrymal region not so long as in *E. europæus*, and less distinctly marked off from general contour

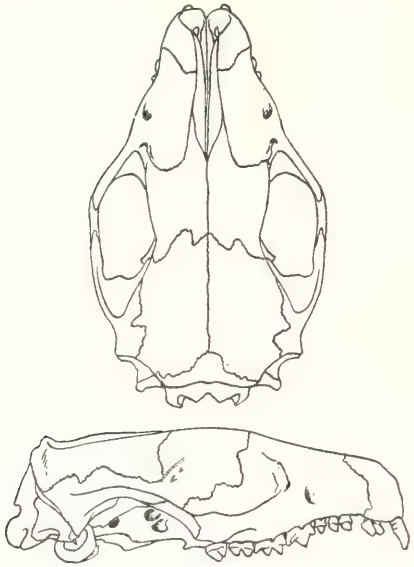

FIG. 24.

Erinaceus roumanicus. Nat. size.

of skull, its degree of development somewhat as in *E. algirus*. Teeth not certainly distinguishable from those of *Erinaceus europæus*, though anterior upper premolar is usually larger relatively to canine, and its posterior cusplet tends to be better developed.

Measurements.—External measurements of adult male and female from vicinity of Königsberg, Germany: head and body, 285 and 280; tail, 21 and 22; hind foot, 42 and 41. Type (adult female): head and body, 206; tail, 24; hind foot, 40·6. Adult female from Corfu, Greece: head and body, 263; tail, 37; hind foot, 43; ear, 29. Adult male from Cephalonia, Greece: head and body, 260; tail, 35; hind foot, 42; ear, 31. For cranial measurements see Table, p. 132.

Specimens examined.—Eleven, from the following localities:—
GERMANY: Near Königsberg, 3 (U.S.N.M.).

Austria-Hungary: Haida, Arva, Bohemia, 1; Vasoár, Eisenburg, Hungary, 1 (U.S.N.M.).
Roumania: Gageni, Prahova, 2.
Greece: Corfu, 2; Cephalonia, 1; Tatoi, near Athens, 1.

Remarks.—Though at first sight very similar to *Erinaceus europæus*, this species is easily recognizable by its cranial characters. In most specimens there is a strong contrast between the dark posterior portion of underparts and whitish chest, throat and shoulders, a pattern which appears to be rarely if ever well developed in the related species.

♀.	Haida, Bohemia.	Lord Lilford (p).	97. 8. 14. 1.
♂, ♀.	Gageni, Prahova, Roumania. (*W. Dodson.*)	Lord Lilford (p). (*Type* of species 4. 4. 6. 16.)	4. 4. 6. 15–16.
♂.	Potamos, Corfu, Greece. (*C. Mottaz.*)	J. I. S. Whitaker (p).	8. 10. 1. 6.
♀.	Argostoli, Cephalonia. (*C. Mottaz.*)	J. I. S. Whitaker (p).	8. 10. 1. 7.
♂.	Tatoi, Athens.	C. Mottaz (c).	8. 11. 3. 8.

ERINACEUS NESIOTES Bate.

1906. *Erinaceus europæus nesiotes* Bate, Proc. Zool. Soc. London, 1905, II, p. 316, April 5, 1906. Type in British Museum.
1910. *Erinaceus europæus nesiotes* Trouessart, Faune Mamm. d'Europe, p. 40.

Type locality.—Near Gonia, western Crete.
Geographical distribution.—Island of Crete.
Diagnosis.—Similar to *Erinaceus roumanicus* but smaller (hind foot, 35 to 38; condylobasal length of skull in adult male, about 55 mm.); spines not so coarse as in the related species; first upper premolar distinctly larger than canine and of essentially the same height.
Colour.—The colour is like that of *E. roumanicus*. Underparts, sides and face dull whitish grey with faint dark clouding between eye and muzzle, and in one of the three skins with a dark wash on posterior half of underparts.
Skull.—As in *E. roumanicus*, but not attaining as large size.
Measurements.—Adult male* and female from the type locality: head and body, 208 and 204; tail, 29 and 19; hind foot, 40 and 38 (dry, 38 and 35). For cranial measurements see Table, p. 132.

Specimens examined.—Three, all from Crete.

Remarks.—The Cretan hedgehog is nearly related to *Erinaceus roumanicus*, though well differentiated by its smaller size and by the relatively large fourth unicuspid tooth.

♂, ♀.	Gonia, Crete.	Miss D. Bate (c). (5. 12. 2. 11 *Type* of species.)	5. 12. 2. 11 12.
♀.	Mesoghia.	Miss D. Bate (c).	5. 12. 2. 13.

* Type.

ERINACEUS ALGIRUS Duvernoy and Lereboullet.

(Synonymy under subspecies.)

Geographical distribution.—Northern Africa: also in southern Spain, southern France, and the Balearic Islands.

Diagnosis.—Smaller than *Erinaceus europæus* (hind foot less than 40 mm.); spines not so coarse; middle of forehead with bare area among the spines: skull with sagittal crest extending forward to middle of frontal: a wide flattened area on each side of bony palate behind transverse ridge: third upper incisor with two perfectly distinct roots: elevated portion of posterior lower premolar with only two cusps (fig. 25 *b*).

External characters.—Externally *Erinaceus algirus* is distinguishable from *E. europæus* by its smaller size, shorter, more slender and apparently more densely-set bristles, and by the bare area at middle of forehead. This bare area is about 7 mm. wide and extends back about 10 to 15 mm. from front line of spines. In dried skins it is sometimes partly hidden by shrinking. Fur more dense and less coarse than in the larger animal. Claws on front feet seldom attaining a length of 8 mm.

Colour.—The colour resembles in general that of the paler races of *E. europæus*.

Skull.—The form of the skull is essentially as in *E. europæus* except that rostrum is less elevated posteriorly, so that the dorsal profile tends to become slightly concave. Sagittal crest when fully developed extending forward to middle of frontal, while in *E. europæus* it is usually confined to parietals, rarely encroaching on posterior edge of frontal. Ridge at margin of orbit very short, scarcely more than a process above lachrymal foramen. Bony palate extending behind transverse ridge as a well defined flat area divided along median suture by a longitudinal ridge representing the median spine of *E. europæus*. Basisphenoid pit narrower, relatively deeper, and with more overhanging edges than in *E. europæus*.

Teeth.—In general the teeth show no departure from those of *E. europæus*. The posterior lower premolar, however, lacks all trace of the metaconid, so that the resemblance of the elevated portion of the tooth to the first triangle of m_1 and m_2 is completely destroyed. In the upper jaw the third incisor, canine, and first premolar are two-rooted, apparently without exception.

a *b*

FIG. 25.

Large lower premolar of *Erinaceus europæus* (*a*) and *E. algirus* (*b*). × 3.

Measurements. Head and body about 200 to 250; tail, 25 to 40; hind foot, 32 to 37; condylobasal length of skull, 54 to 59 mm.

Remarks.—This species is readily distinguishable from *Erinaceus europæus* by the bare spot among spines of forehead, the perfectly two-cusped large lower premolar, and the two-rooted third upper

incisor. Although occurring wild in southern Spain, on the Balearic Islands, and in south-eastern France, it seems not improbable that the animal owes its presence in Europe to the agency of man.

Erinaceus algirus algirus Duvernoy and Lereboullet.

1840. *Erinaceus algirus* Duvernoy and Lereboullet, Mém. Soc. Mus. d'Hist. Nat. Strasbourg, III, fasc. 2, p. 4.
1898. *Erinaceus algirus* de Winton, Proc. Zool. Soc. London, 1897, p. 955.

Type locality.—Oran, Algeria.

Geographical distribution.—Northern Africa; also in southern Spain and south-eastern France.

Diagnosis.—Condylobasal length of skull in individuals with distinctly worn teeth 57 to 59 mm.; underparts dusky throughout or with at least an evident dark wash in interramial and intercrural regions.

Colour.—Furred area buffy white to base of hairs, except on muzzle, cheeks, interramial region, a narrow band along sides bordering quills and spreading posteriorly to cover tail, hind legs and intercrural region, all of which are a dark brown, very nearly the bister of Ridgway. Feet a lighter shade of the same brown. Occasionally the brown suffusion extends over most of ventral surface. Quills dull horn-colour, each with a whitish sub-terminal area about 7 mm. in length, the extreme tip usually dark. Throughout the spiny area the whitish strongly predominates, especially when animal is viewed from in front. Claws light yellowish horn-colour.

Measurements.—Adult male from Schaf-el-Kab, Morocco (teeth much worn): head and body, 206; tail, 26; hind foot, 32. For cranial measurements see Table, p. 132.

Specimens examined.—Numerous specimens from Northern Africa; also an adult from "Andalucia," Spain; a young, less than half grown, from Elche, Alicante, Spain; and a still younger specimen from Lecques, Var, France.

Remarks.—Owing to the unsatisfactory nature of the Spanish and French material the status of the Continental European hedgehogs of the *Erinaceus algirus* group is at present doubtful. Should they prove to be identical with the North African form it would seem probable that they have been introduced within historic times. The specimen from Elche, though undoubtedly a wild-bred animal, is too young to be positively determined as to geographical race. The same is even more true of that from Var. The adult from "Andalucia" lacks detailed history. Externally it resembles the African form as compared with *E. algirus vagans*, but the skull is small,* essentially as in the Balearic race.

* Condylobasal length, 53·8; zygomatic breadth, 32·0; least interorbital breadth, 14·8; mandible, 41·2; upper tooth-row, 27·0; lower tooth-row, 22·0.

CRANIAL MEASUREMENTS OF *ERINACEUS ROUMANICUS*, *E. NESIOTES*, AND *E. ALGIRUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Mastoid breadth.	Postorbital constriction.	Breadth of rostrum at premaxillary suture.	Palatal depth behind m^3 (lateral).	Mandible.	Maxillary tooth-row (entire : alveoli).	Mandibular tooth-row (entire : alveoli).	Observations.
E. roumanicus.												
Germany: Königsberg	112336	♀	59·0	35·0	28·0	14·8	12·2	18·2	43·2	29·6	23·2	Teeth slightly worn.
,,	112338	♂	59·6	35·4	28·6	15·0	12·8	18·2	43·6	29·0	23·0	,, moderately worn.
Austria-Hungary: Vasoár, Eisenburg	38335	♂	59±	36·2	29·0	15·2	—	17·8	44·8	30·2	23·8	,, slightly worn.
Roumania: Gageni	4. 4. 6. 15	♂	55·0	32·6	27·0	13·8	12·6	17·0	42·0	27·8	23·0	,, ,,
,,	4. 4. 6. 16*	♀	58·2	36·0	30·0	16·0	12·2	17·2	44·0	29·4	23·4	,, moderately worn.
Greece: Tatoi, near Athens	8. 11. 3. 8	♂	64·2	38·8	32·6	15·6	14·0	18·6	48·2	32·0	25·4	,, ,,
Cephalonia	8. 10. 1. 7	♀	58·8	36·0	29·4	14·8	12·8	18·0	45·0	29·0	23·2	,, much worn.
Corfu	8. 10. 1. 6	♂	58·8	36·0	29·4	15·0	13·0	18·2	43·4	30·0	23·0	,, moderately worn.
,,	153418	♀	59·4	35·2	30·0	14·6	12·4	18·6	42·6	29·8	22·6	,, slightly worn.
E. nesiotes.												
Crete	5. 12. 2. 11*	♂	55·0	34±	28·0	13·6	13·0	17·0	41·0	27·2	22·8	,, ,,
,,	5. 12. 2. 12	♀	53·0	31·8	27·0	14·6	11·8	15·6	40·2	27·0	22·0	,, moderately worn.
E. algirus algirus.												
Morocco: Schaf-el-Kab	98. 7. 4. 6	♂	57·6	34·4	27·4	15·2	11·8	17·0	43·6	28·4	22·0	,, much worn.
,, ,,	98. 7. 4. 36		58·0	35·2	28·0	14·8	12·0	18·2	43·2	28·8	23·4	,, ,,
E. algirus vagans.												
Spain: Minorca, Balearic Islands	0. 7. 1. 36*	♂	54·0	33·0	25·6	14·0	12·0	18·0	41·4	27·2	22·2	,, ,,
,, ,,	0. 7. 1. 39	♀	48·4	30·4	24·0	13·8	11·0	16·0	38·0	25·2	21·2	,, slightly worn.

* Type.

1.	Andalucia, Spain.	Lord Lilford (P).	94. 6. 11. 5.
♂ juv.	Elche, Alicante.	G. S. Miller (C).	8. 8. 4. 16.
juv. al.	Lecques, Var, France.	Dr. P. Siepi (P).	98. 8. 25. 1.

Erinaceus algirus vagans Thomas.

1901. *Erinaceus algirus vagans* Thomas, Proc. Zool. Soc. London, p. 38. Type in British Museum.
1910. *Erinaceus algirus vagans* Trouessart, Faune Mamm. d'Europe, p. 39.

Type locality.—San Cristobal, Minorca, Balearic Islands.

Geographical distribution.—Balearic Islands.

Diagnosis.—Condylobasal length of skull in individuals with worn teeth about 54 mm. ; furred area of body whitish throughout, with no evident dark wash on face, in interramial or intercrural regions, or on feet.

Measurements.—Type (adult male) : head and body, 250 ; tail, 40 ; hind foot, 37. Adult male from Inca, Majorca : head and body, 218 ; tail, 31 ; hind foot, 35. For cranial measurements see Table, p. 132.

Specimens examined.—One from Majorca and five from Minorca, Balearic Islands.

Remarks.—The Balearic form of *Erinaceus algirus* is distinguishable from the African race by its paler colour and smaller size. Its relationship to the animal occurring on the mainland of southern Spain is not at present clear.

♂.	Inca, Majorca ; 300 m. Balearic Islands.	O. Thomas & R. I. Pocock (C & P).	0. 7. 1. 6.
4 ♂, ♀.	San Cristobal, Minorca.	O. Thomas & R. I. Pocock (C & P).	0. 7. 1. 35 39. (0. 7. 1. 36. *Type* of subspecies.)

Order CHIROPTERA.

1779. *Chiroptera* Blumenbach, Handbuch der Naturgeschichte, p. 74.

Geographical distribution. Practically cosmopolitan; only absent from the treeless arctic and antarctic regions, and from the most remote islands of the Pacific and South Atlantic oceans.

Characters. Terrestial placental mammals with the anterior limbs modified for true flight, the fingers greatly elongated (third usually at least as long as head and body) and joined together by a membrane which extends to sides of body and legs; shoulder girdle much more developed than pelvis, the sternum usually keeled; knee directed backward.

Remarks.—The order *Chiroptera*, containing the only living vertebrates, except birds, capable of true flight, is the most sharply circumscribed of the main groups of mammals. Not only are its living members invariably distinct from all other recent forms, but the fossils also are, so far as known, equally well differentiated. Therefore no intermediate stage has yet been found connecting the bats with any other order. That they are, however, not distantly related to the *Insectivora*, is shown by numerous peculiarities of structure, among others the relatively simple character of the brain. Two sub-orders are recognized among the recent members of the order, the *Megachiroptera*, not represented in Europe, with less highly modified skeleton of fore limb, and more modified teeth, and the *Microchiroptera* with more highly developed wing and in most instances more primitive teeth.

Sub-Order MICROCHIROPTERA.

1821. *Insectivora* Gray, London Medical Repository, xv, p. 299, April 1, 1821.

1872. *Animalivora* Gill, Arrangement of the Families of Mammals, p. 16, November, 1872.

1875. *Microchiroptera* Dobson, Ann. and Mag. Nat. Hist., 4th ser., xvi, p. 346, November, 1872.

1878. *Microchiroptera* Dobson, Catal. Chiropt. Brit. Mus., p. 2.

1907. *Microchiroptera* Miller, Families and Genera of Bats, p. 78, June 29, 1907.

Geographical distribution. The same as that of the order. In Europe north to the limits of tree growth, west to Ireland and the Azores.

Characters.—Anterior limb very highly modified, the second finger scarcely if at all independent of third, its ungual phalanx never present, the humerus with trochiter and trochin large, the former usually articulating with scapula; mandible with angular process well developed, long and narrow; teeth usually not modified for frugivorism (never in European species), the cheek-teeth of upper and lower jaws very different from each other (except when excessively reduced, as in the South American *Desmodontidæ*); margin of ear not forming a ring; tragus usually present. Mammæ in all European genera, $p\,1{-}1 = 2$.

Remarks.—The sub-order *Microchiroptera* is essentially cosmopolitan in distribution. Though more highly modified than the *Megachiroptera* in wing structure, the members of this group for the most part retain the primitive tuberculo-sectorial type of molar tooth, though certain South American frugivorous forms show the stages through which the Megachiropterine molars have probably passed. At present 17 families and nearly 150 genera are recognized; the species are too imperfectly known to permit any approximate estimate of their number. Three families and ten genera are found in Europe.

KEY TO THE EUROPEAN FAMILIES AND SUB-FAMILIES OF *MICROCHIROPTERA*.

Tragus absent; muzzle with leaf-like outgrowths; premaxillaries represented by palatal branch only, not fused with surrounding parts (often lost in prepared specimens) ..... *Rhinolophidæ*, p. 136.

Tragus present; muzzle without leaf-like outgrowths; premaxillaries represented principally (entirely in European genera) by nasal branch, very early and completely fused with surrounding parts.

Fibula robust, its diameter about half that of tibia; tail projecting conspicuously beyond hinder edge of narrow interfemoral membrane..... *Molossidæ*, p. 276.

Fibula very slender, its diameter much less than half that of tibia; tail scarcely or not projecting beyond hinder edge of broad interfemoral membrane..... *Vespertilionidæ*, p. 165.

Presternum with median lobe much smaller than body of bone; coracoid curved outward; second phalanx of third finger not specially elongated..... *Vespertilioninæ*, p. 165.

Presternum with median lobe larger than body of bone; coracoid straight, directed inward; second phalanx of third finger nearly three times as long as first ..... *Miniopterinæ*, p. 268.

KEY TO THE GENERA OF EUROPEAN BATS.

(A wholly artificial key based primarily on external characters.)

Muzzle with leaf-like outgrowths ..... *Rhinolophus*, p. 137.
Muzzle without leaf-like outgrowths.
  Tail projecting conspicuously beyond membrane ... *Nyctinomus*, p. 276.
  Tail not projecting conspicuously beyond membrane.
    Ears joined.
      Ear longer than head ..... *Plecotus*, p. 256.
      Ear shorter than head..... *Barbastella*, p. 263.
    Ears separate.
      Second phalanx of third finger nearly three times as long as first ..... *Miniopterus*, p. 268.
      Second phalanx of third finger less than twice as long as first.
        Fifth finger about as long as metacarpal of fourth or third ..... *Nyctalus*, p. 242.
        Fifth finger much longer than metacarpal of fourth or third.
          Ear wider than high, its lower margin forming a small pocket near angle of mouth..... *Vespertilio*, p. 238.
          Ear higher than wide, its lower margin not forming pocket near angle of mouth.
            Upper cheek-teeth 6–6..... *Myotis*, p. 166.
            Upper cheek-teeth less than 6–6.
              Upper cheek-teeth 5–5..... *Pipistrellus*, p. 202.
              Upper cheek-teeth 4–4..... *Eptesicus*, p. 224.

FAMILY RHINOLOPHIDÆ.

1827. *Rhinolophina* Lesson, Man. de Mammalogie, p. 81 (part).
1857. *Phyllostomata* Blasius, Säugethiere Deutschlands, p. 26.
1866. *Rhinolophidæ* Gray, Proc. Zool. Soc. London, p. 81 (part).
1878. *Rhinolophidæ* Dobson, Catal. Chiropt. Brit. Mus., p. 100 (part).
1907. *Rhinolophidæ* Miller, Families and Genera of Bats, p. 106, June 29, 1907.

Geographical distribution.—Tropical and temperate portions of the Old World from Ireland east to the Philippine Islands, Solomon Islands and north-eastern Australia. In Europe north to northern England and the Baltic coast of Germany.

Characters.—Ear without tragus; muzzle with conspicuous leaf-like cutaneous outgrowths (fig. 26) consisting of a horizontal anterior horseshoe, a perpendicular median sella, and a posterior erect lancet: skull with premaxillaries represented by palatal branches only, the two bones partly cartilaginous and not fused with surrounding parts (often lost in prepared specimens); shoulder girdle highly abnormal, the seventh cervical and first dorsal vertebræ, first and second ribs, and presternum fused into a continuous ring; secondary articulation of humerus with scapula small but distinct; fibula thread-like; foot normal, the hallux with two phalanges, the other toes with three.

Remarks.—The *Rhinolophidæ* are the most widely distributed

of the Old World leaf-nosed bats, and the only family known to occur in Europe. Notwithstanding its extensive distribution and its large number of species the group is represented by a single genus.

Genus **RHINOLOPHUS** Lacépède.

1799. *Rhinolophus* Lacépède, Tabl. des div. sousdiv. ordres et genres des Mammifères, p. 15 (*ferrum-equinum*).
1836. *Rhinocrepis* Gervais, Dict. Pittoresque d'Hist. Nat. IV, pt. 2, p. 617 (attributed to Geoffroy and Cuvier, Mag. Encyclopédique, 1795, but the name does not occur in the paper alluded to).
1847. *Aquias* Gray, Proc. Zool. Soc. London, p. 15 (*luctus* and *trifoliatus*).
1857. *Rhinolophus* Blasius, Säugethiere Deutschlands, p. 26.
1866. *Phyllotis* Gray, Proc. Zool. Soc. London, p. 81 (*philippensis*) not *Phyllotis* Waterhouse, 1837.
1866. *Cœlophyllus* Gray, Proc. Zool. Soc. London, p. 427 (*cœlophyllus*).
1878. *Rhinolophus* Dobson, Catal. Chiropt. Brit. Mus., p. 100.
1901. *Euryalus* Matschie, Sitz.-Ber. Gesellsch. naturforsch. Freunde, Berlin, p. 225 (*mehelyi*).
1904. *Euryalus* Matschie and Andersen, Sitz.-Ber. Gesellsch. naturforsch. Freunde, Berlin, p. 71 (*euryale* group).
1907. *Rhinolophus* Miller, Families and Genera of Bats, p. 108, June 29, 1907.

Type species.—*Vespertilio ferrum-equinum* Schreber.

Geographical distribution.—Same as that of family (p. 136).

Characters.—Dental formula : $i\frac{1-1}{2-2}$, $c\frac{1-1}{1-1}$, $pm\frac{2-2}{3-3}$, $m\frac{3-3}{3-3} = 32$. Upper incisor very small, but usually well formed and with distinct rounded crown with slight cusp on inner side. Lower incisors trifid, the outer larger than inner, the four teeth forming a continuous row between canines. Upper canine heavy, but without secondary cusps or conspicuous cingulum. Lower canine rather weak. Anterior upper premolar (pm^3) and middle lower premolar (pm_3) small, functionless, usually crowded quite out of tooth-row. Other teeth showing no special peculiarities; m^1 and m^2 without hypocone, m^3 with five cusps and three commissures (in many species a rudimentary fourth commissure), the crown area much more than half that of m^1 or m^2. Skull with large brain-case and much shortened, globularly inflated rostrum, beyond which the maxillaries, bearing the large canines, conspicuously project; palate so deeply emarginated both anteriorly and posteriorly that its median length is less than least distance between tooth-rows. Tail well developed, extending to edge of wide interfemoral membrane. Calcar slender. Ears large, separate, without tragus. Muzzle with conspicuous leaf-like cutaneous outgrowths, consisting of a horizontal anterior horseshoe, a perpendicular median sella and an erect posterior lancet (fig. 26).

Remarks. Among European bats the members of the genus *Rhinolophus* are at once recognizable by the presence of the nose-

leaf and absence of tragus. The skull differs from that of all other members of the fauna in the short, globularly inflated rostrum and long, projecting maxillaries, between which lie the

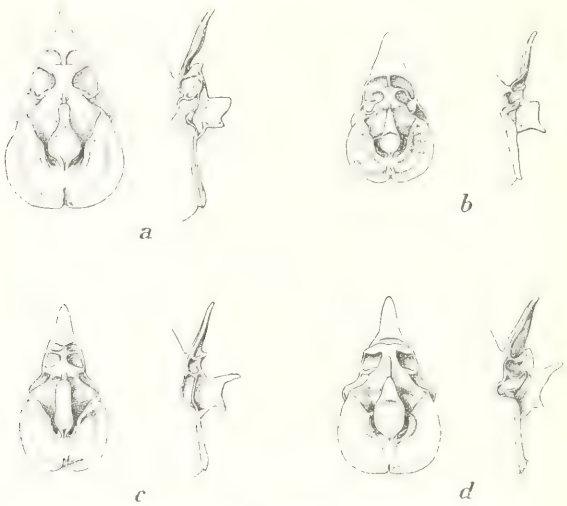

FIG. 26.

Noseleaf of *Rhinolophus ferrum-equinum* (a), *R. hipposideros* (b) *R. euryale* (c) and *R. blasii* (d). Nat. size.

horizontal free premaxillaries (often lost in prepared specimens). About 100 forms have been described,* eight of which occur in Europe.

KEY TO THE EUROPEAN FORMS OF RHINOLOPHUS.

Noseleaf with connecting process broadly rounded above; skull with nasal swellings long, rising gradually above line of forehead.

Forearm over 50 mm.; condylobasal length of skull over 20 mm.; sella pandurate; large upper premolar in contact with canine (Greater Horseshoe) ..... *R. ferrum-equinum*, p. 139.

Wing relatively long; forearm 54–58 mm., longest finger 84 to 92 mm. (Southern and central Continental Europe)..... *R. f. ferrum-equinum*, p. 142.

Wing relatively shorter; forearm 52 to 55 mm., longest finger 83 to 88 mm. (England) ..... *R. f. insulanus*, p. 147.

* See Andersen, Ann. and Mag. Nat. Hist., 7th ser., XVI, pp. 648-662.

Forearm under 43 mm.; condylobasal length of skull under 16 mm.; sella cuneate; large upper premolar not in contact with canine (Lesser Horseshoe)..... *R. hipposideros*, p. 147.
Greatest length of skull 14·5 to 15·5 mm. (Mediterranean region) ..... *R. h. minimus*, p. 151.
Greatest length of skull more than 15·5 mm.
Forearm 36·3 to 39 mm. (England and Ireland) ..... *R. h. minutus*, p. 154.
Forearm 39 to 41·7 mm. (Central Europe) *R. h. hipposideros*, p. 149.
Noseleaf with connecting process acutely pointed above; skull with nasal swellings short, rising abruptly above level of forehead.
First phalanx of fourth finger more than half as long as second; sella bluntly cuneate; no marked contrast between crown areas of anterior and posterior lower premolars (Eastern Mediterranean region) ..... *R. blasii*, p. 162.
First phalanx of fourth finger less than half as long as second; sella parallel-sided, broadly rounded above; a marked contrast between crown areas of anterior and posterior lower premolars.
Size smaller, forearm 44·6 to 49 mm., upper tooth-row 6·2 to 6·6 mm.; gradation between phalanges of fourth finger abrupt (ratio of first to second about 38); point of lancet gradually narrowed, never linear..... *R. euryale*, p. 155.
Size larger, forearm 48·6 to 51·4, upper tooth-row about 7 mm.; gradation between phalanges of fourth finger less abrupt (ratio of first to second about 44); point of lancet linear ..... *R. mehelyi*, p. 159.

RHINOLOPHUS FERRUM-EQUINUM Schreber.

(Synonymy under subspecies.)

Geographical distribution.—From southern Japan and China, through the Himalayas, the Mediterranean sub-region (exclusive of Egypt), and central Europe to southern England (Andersen).

Diagnosis.—Size largest of the European species (forearm more than 50 mm., condylobasal length of skull about 21 mm., mandible, 15 to 16 mm.); noseleaf with horseshoe less than 10 mm. wide, the sella pandurate, the connecting process low, abruptly rounded; fourth finger with first phalanx considerably more than half as long as second; large upper premolar broadly in contact with canine, the small premolar minute (sometimes absent), completely external to tooth-row.

External characters.—Size large and form rather heavy (among the European members of the genus). General outline of noseleaf a rather elongate ovate-pyriform, the width of horseshoe slightly greater than distance from flat area at base of sella

to tip of lancet. Sella broadly rounded at tip, noticeably constricted somewhat above middle, the resulting outline pandurate. Connecting process rising slightly but evidently above level of sella, its upper border straight anteriorly, its tip rather abruptly rounded off. Ear large, extending when laid forward slightly beyond extremity of muzzle, abruptly narrowed to a rather acute recurved tip; antitragal lobe less than half as high as conch, its width about equal to its height, its upper border nearly horizontal. Wings broad, the membrane attached to ankle. First phalanx of fourth finger noticeably more than half as long as second. Foot slender, nearly half as long as tibia.

Colour.—General effect a light greyish or drabby brown produced by varying combinations of the pale ecru-drab under colour and the darker hair tips, the region between ears, across shoulders and at sides of lumbar region usually paler than back. The colour of the tips is usually either a clear, rather light sepia, or a buffy brown resembling the wood-brown of Ridgway. While intermediate shades occur the extremes are more often met with, evidently representing two dichromatic phases. Underparts usually rather lighter than back but never approaching whitish.

Skull. General outline of skull long and narrow, the breadth of brain-case much less than twice that across canines, and contained about $2\frac{1}{2}$ times in greatest length; zygomata projecting slightly beyond general outline; interorbital region greatly constricted and conspicuously hour-glass shaped; occipital portion of brain-case noticeably overhanging foramen magnum and marked off from main portion by a slight transverse depression corresponding to suture between parietals and unusually large interparietal; sagittal crest well developed, extending forward to narrowest portion of interorbital region; lambdoid crest low but evident; auditory bullæ small, covering less than half surface of large cochleæ, between which the floor of brain-case is reduced to a longitudinal bridge less than 1 mm. in diameter; mesopterygoid fossa slightly wider anteriorly than posteriorly, about $1\frac{1}{2}$ times as long as wide, its rounded anterior margin at level of postero-internal angle of m^2; palate with an evident emargination on each side extending between m^3 and mesopterygoid space; anterior palatal emargination extending back to line joining protocones of anterior molars; premaxillary ligulate, somewhat wider posteriorly than anteriorly, the inner border entire, the outer border with a deep almost circular emargination posteriorly, the two bones closely applied to each other along inner margin and to

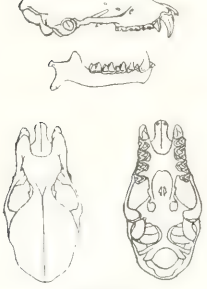

FIG. 27.
Rhinolophus ferrum-equinum.
Nat. size.

bottom of palatal emargination posteriorly, but otherwise free: rostral inflation evident but low, its posterior border running gradually into that of interorbital region, its anterior margin over middle of anterior molar; maxillary triangular in outline when viewed from the side, the heavy canine projecting forward and downward from its anterior apex; anteorbital foramen small, over middle of second molar and directly beneath minute lachrymal foramen, the plate forming outer wall of canal thread-like, occasionally absent.

Teeth.—Except for the minute premolars and upper incisors the teeth are robust and heavy relatively to size of skull. Upper incisor minute, low, the crown subterete, wider than root, lower externally than internally, each tooth placed near middle of oblique anterior border of premaxillary, the space between the two nearly double diameter of crown. Lower incisors strongly imbricated, forming a short, very convex row between canines, their crowns longer than high, compressed (the outer tooth less than the inner), deeply and equally trifid. Upper canine very large, and noticeably the highest tooth in the maxillary series, the root oblique, the shaft abruptly bent downward at level of well developed cingulum, its length along cingulum about three-fourths height; cross section of shaft triangular, the inner surface flattened, slightly concave near cingulum, the posterior edge trenchant, the anterior edge narrowly sub-trenchant, the outer surface with well developed median longitudinal ridge and noticeable posterior concavity. Lower canine not so large as upper, the flattened surface of its shaft directed posteriorly to oppose front of upper canine in mastication. Anterior upper premolar minute, resembling upper incisor in both size and form, entirely external to tooth-row, occasionally absent. Posterior upper premolar large, closely crowded against canine, its crown area about equal to that of second molar, without secondary cusps, its main cusp intermediate in height between canine and metacone of first molar; posterior border of crown slightly but evidently emarginate. Anterior lower premolar less than half as high as posterior premolar and with barely half its crown area, the two teeth crowded closely together between canine and first molar; shaft of anterior tooth with slightly developed concave area on inner side, that of posterior tooth with better defined posterior concavity, its inner side convex; middle lower premolar resembling anterior upper premolar, its position equally external to tooth-row. Upper molar with large though not unusually high protocone, behind which in m^1 and m^2 there is a low-lying heel (best developed in m^1), but no indication of a true hypocone; paracone and metacone well developed, the latter slightly the higher in m^1 and m^2, this reversed in m^3; styles and commissures in m^1 and m^2 well developed, forming a normal W-pattern; in m^3 the metastyle and fourth commissure are absent, and the third commissure is much reduced in length; crown area of m^3

about two-thirds that of m^3; lower molars with protoconid noticeably higher than the other cusps, the posterior triangle slightly the wider of the two in m_1 and m_2, a little the narrower in m_3; behind entoconid the cingulum forms a minute though evident accessory cusp.

Remarks.—Among the leaf-nosed bats of Europe this species is easily recognizable by its large size taken in connection with the low, rounded upper margin of the connecting process of sella. In *R. mehelyi*, which approaches it in size, the connecting process is sharply pointed above. Two geographical races are known, one occupying the Continental range of the species, the other confined to Great Britain.

Rhinolophus ferrum-equinum ferrum-equinum Schreber.

1774. *Vespertilio ferrum-equinum* Schreber, Säugthiere, I, pl. LXII, upper figures; description, I, p. 174 under name: Die Hufeisennase (part). France; based primarily on Daubenton.

1776. *Vespertilio equinus* P. L. S. Muller, Natursyst. Suppl. u. Regist.-Band, p. 20 (part), France.

1779. [*Vespertilio*] *perspicillatus* Blumenbach, Handb. d. Naturgesch., p. 75 (part: included the leaf-nosed bats of Europe and South America).

1785. *Vespertilio unauda* Boddaert, Elenchus Animalium, I, p. 71 (Burgundy).

1792. *Vesp*[*ertilio*] *fer*[*rum*]*-equ*[*inum*] *major* Kerr, Anim. Kingd., p. 99 (not *V. molossus major* Kerr, l.c., p. 97), France.

1798. *Vespertilio hippocrepis* Schrank, Fauna Boica, I, p. 64 (Renaming of *ferrum-equinum* Schreber).

1803. *Rhinolophus major* Geoffroy, Catal. Mamm. Mus. Nat. d'Hist. Nat., Paris, p. 56 (Burgundy).

1813. *Rhinolophus unihastatus* Geoffroy, Ann. Mus. d'Hist. Nat., Paris, XX, p. 257 (France).

1829. ? *Rhinolophus unifer* Kaup, Entw.-Gesch. u. Natürl. Syst. Europ. Thierwelt, I, p. 104 (nomen nudum).

1857. *Rhinolophus ferrum-equinum* Blasius, Säugethiere Deutschlands, p. 31.

1863. *Rhinolophus ferrum-equinum* α var. *germanicus* Koch, Jahrb. des Vereins für Naturkunde im Herzogthum Nassau, XVIII, p. 522 (Wiesbaden, Hessen-Nassau, Germany).

1863. *Rhinolophus ferrum-equinum* β var. *italicus* Koch, Jahrb. des Vereins für Naturkunde im Herzogthum Nassau, XVIII, p. 523 (Italy).

1878. *Rhinolophus ferrum-equinum* Dobson, Catal. Chiropt. Brit. Mus., p. 119 (part).

1885. *Rhinolophus unihastatus* var. *homorodalmasiensis* Daday, Orvos-Termeszettudományi Értesetö, Kolozsvar, X, p. 274 (Homorod-Almas cave, Hungary).

1886. *Rhinolophus unihastatus* var. *homorodalmasiensis* Daday, Verhandl. u. Mittheilungen des Siebenbürgischen Vereins für Naturwissensch. in Hermannstadt, XXXVI, p. 79.

1887. *Rhinolophus ferrum-equinum* var. *homorodensis* Daday, Ertekezések a Természettudományok Köréből, Budapest, XVI, pt. 7, p. 13 (Renaming of *homorodalmasiensis*).

1904. *Rhinolophus ferrum-equinum obscurus* Cabrera, Mem. Soc. Españ. Hist. Nat. Madrid, II, p. 257 (Valencia, Spain).

1905. *Rhinolophus ferrum-equinum typicus* Andersen, Proc. Zool. Soc. London, 1905, II, p. 113, October 17, 1905.

1905. *Rhinolophus ferrum-equinum obscurus* Andersen, Proc. Zool. Soc. London, 1905, II, p. 116, October 17, 1905.

1910. *Rhinolophus ferrum-equinum, R. ferrum-equinum obscurus* and *R. ferrum-equinum homorodensis* Trouessart, Faune Mamm. d'Europe, pp. 4–5.

Type locality.—Burgundy, France.

Geographical distribution.—Central and southern Continental Europe.

Diagnosis.—Wing relatively long; **forearm**, 54 to 58 mm.; third finger, 84 to 92 mm.

Measurements.—Average and extremes of six males from Silos, Burgos, Spain: head and body, 62·1 (58–64·4); tail, 39·9 (37·6–43); tibia, 23·2 (21·8–24); foot, 11·7 (11–13); **forearm**, 55·1 (54·8–55·4); third finger, 89·3 (88–92); fifth finger, 72·5 (72–73); ear from meatus, 24·9 (24–26). Average and extremes of five females from Silos, Burgos, Spain: head and body, 61·8 (60–66); tail, 38·8 (37–42); tibia, 23·1 (22·6–24); foot, 11·7 (11–13); **forearm**, 56·2 (56–57); third finger, 89·6 (88–91); fifth finger, 73·4 (71–76); ear from meatus, 25·1 (24·8–26). Two males from Granada, Spain: **forearm**, 54 and 54. Two females from the same locality: **forearm**, 56 and 58. Two males from Elche, Alicante, Spain: **forearm**, 54 and 55. Average and extremes of six adults (3 males and 3 females) from St. Genies, Gard, France: tibia, 24·1 (23·4–24·6); foot, 12·1 (11·8–12·8); **forearm**, 55·4 (54–65); third finger, 87·3 (84–91); fifth finger, 71·5 (69–74). Female from Marseilles, France: **forearm**, 57. Male and female from near Genoa, Italy: **forearm**, 57 and 57. Two females from Rimini, Italy: **forearm**, 53 and 57. Female from Siena, Italy: **forearm**, 54. Male from Rome, Italy: **forearm**, 56. Male from the Parnassus region, Greece: **forearm**, 54. Adult female from Tübingen, Würtemberg, Germany: head and body, 63; tail, 37; tibia, 24·4; foot, 11; **forearm**, 56·6; third finger, 88; fifth finger, 72; ear from meatus, 24; width of ear, 16. Adult female from Ofener Mts., Hungary: head and body, 61; tail, 40; tibia, 24; foot, 11·6; **forearm**, 56; third finger, 87; fifth finger, 73; ear from meatus, 23·4; width of ear, 16. Two males from Herkulesbad, Hungary: **forearm**, 56·6 and 58. Four females from Herkulesbad, Hungary: **forearm**, 56, 56·4, 56·6 and 57·4. For cranial measurements see Table, p. 144.

Specimens examined.—One hundred and forty-one, from the following localities:—

PORTUGAL: Cintra, 1.

SPAIN: Silos, Burgos, 22; Granada, 4; Elche, Alicante, 3; San Cristobal, Minorca, Balearic Islands, 4.

CRANIAL MEASUREMENTS OF *RHINOLOPHUS FERRUM-EQUINUM*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case at middle.	Mandible.	Maxillary toothrow.	Mandibular toothrow.	Observations.
R. ferrum-equinum insulanus.												
England: Dorsetshire . .	11. 1. 3. 1	♀	20·4	11·8	2·8	6·0	9·0	6·0	15·2	8·4	9·0	Teeth not worn.
,, . .	11. 1. 3. 2	♀	20·6	11·6	2·6	6·0	8·8	6·0	15·0	8·2	9·0	,, moderately worn.
,, . .	343	♀	20·6	12·0	2·6	6·0	9·0	6·0	15·2	8·4	9·0	,, slightly worn.
Cheddar, Somersetshire	7. 1. 10. 1	♀	21·4	12·0	2·4	6·0	9·0	6·0	15·4	8·4	9·0	,, not worn.
,, ,,	7. 1. 10. 2	♀	21·0	11·8	2·4	6·0	9·0	6·4	15·2	8·4	9·0	,, slightly worn.
,, ,,	7. 1. 10. 3[a]	♂	21·6	12·0	2·4	6·2	9·0	6·6	15·6	8·6	9·0	,, ,,
Wells ,,	152523	♂	21·0	11·6	2·6	6·0	9·0	6·4	15·2	8·6	9·2	,, not worn.
,, ,,	11. 1. 3. 3	♂	21·2	12·0	2·4	6·0	9·0	6·2	15·4	8·8	9·0	,, slightly worn.
R. ferrum-equinum ferrum-equinum.												
France: Troubate . . .	152525	♂	21·0	11·6	2·4	6·0	9·0	6·4	15·2	8·6	9·0	,, ,,
,, . . .	152526	♂	20·6	11·2	2·6	6·0	8·8	6·4	15·2	8·4	9·0	,, not worn.
Switzerland: Geneva . .	142581	♂	21·0	11·8	2·4	6·0	9·2	6·4	15·6	8·2	9·0	,, ,,
Italy: Genoa	38342	♂	21·8	12·2	2·4	6·4	9·2	6·6	16·0	8·8	9·2	,, much worn.
,, ...	38343	♀	21·6	12·0	2·6	6·4	9·2	6·4	15·6	8·4	9·0	,, ,,
Finalborgo . . .	4 Genoa	♀	21·0	11·6	2·6	6·0	9·0	6·4	15·4	8·2	8·8	,, not worn.
Borzoli	,,	♂	21·0	12·4	2·6	6·2	9·2	6·6	15·2	8·2	9·0	,, moderately worn.

Italy: San Martino al Cimino, Rome	1 Genoa	♀	20·6	12·0	2·4	6·0	9·0	6·4	15·4	8·4	9·2	Teeth moderately worn.
,, ,,	,,	♀	21·0	12·0	2·4	6·0	9·0	6·4	15·4	8·4	9·0	,, slightly worn.
Hungary: Herkulesbad	7. 9. 16. 1	♂	22·0	12·6	2·2	6·0	9·0	6·4	16·2	8·8	9·0	,, ,,
,,	7. 9. 16. 2	♂	21·6	12·0	2·4	6·2	9·0	6·4	15·8	8·8	9·2	,, ,,
,,	7. 9. 16. 3	♀	21·2	11·8	2·8	6·0	9·0	6·2	15·8	8·6	9·0	,, ,,
,,	7. 9. 16. 4	♀	21·2	11·6	2·2	6·2	8·8	6·0	15·0	8·4	9·0	,, ,,
,,	7. 9. 16. 6	♀	21·8	12·0	2·4	6·0	9·0	6·2	16·0	8·8	9·2	,, ,,
Crete	5. 12. 2. 1	♂	20·8	12·4	2·2	6·0	9·0	6·2	15·8	8·2	9·2	,, much worn.
,,	6. 12. 2. 2	♀	21·0	12·0	2·6	6·0	9·2	6·2	15·4	8·4	9·2	,, slightly worn.
,,	5. 12. 2. 3	♀	21·4	12·2	2·4	6·0	9·0	6·2	15·6	8·4	9·0	,, ,,
Spain: Silos, Burgos	172123	♂	21·4	11·8	3·0	6·2	9·0	6·6	15·2	8·6	9·2	,, not worn.
,, ,,	8. 8. 4. 1	♂	20·6	11·4	2·6	6·0	9·2	6·4	15·2	8·2	9·0	,, ,,
,, ,,	8. 8. 4. 2	♂	21·2	11·6	2·6	6·2	9·0	6·2	15·4	8·6	9·2	,, ,,
,, ,,	172124	♀	21·6	11·8	2·8	6·2	9·0	6·4	15·0	8·6	9·0	,, ,,
,, ,,	8. 8. 4. 3	♀	21·6	12·0	2·8	6·4	9·2	6·2	15·4	8·4	9 0	,, ,,
,, ,,	8. 8. 4. 4	♀	20·8	12·0	2·8	6·0	9·0	6·0	15·4	8·2	9·0	,, ,,
Granada	8. 8. 4. 8	♂	21·4	12·0	2·8	6·4	9·0	6·2	15·2	8·6	9·0	,, ,,
,,	8. 8. 4. 9	♀	21·4	11·8	2·6	6·2	9·0	6·2	15·4	8·8	9·2	,, slightly worn.
,,	172129	♀	21 0	11·6	2·8	6·2	8·8	6·2	15·2	8·6	9·0	,, not worn.
Elche, Alicante	8. 8. 4. 7	♀	20·4	11·0	2·8	6·2	8·8	6·0	15·2	8·4	9·0	,, ,,
,, ,,	8. 8. 4. 5	♂	21·4	12·0	2·8	6·0	9·0	6·4	15·2	8·8	9·2	,, slightly worn.
,, ,,	8. 8. 4. 6	♂	21·4	11·6	2·6	6·0	8·8	6·0	15·2	8·4	9·2	,, ,,

* Type.

France: Troubate, Hautes-Pyrénées, 6; St. Genies, Gard, 43 (Mottaz); Marseilles, 1 (U.S.N.M.); Meounes, Var, 1.

Italy: Turin, 1; near Genoa, 8 (B.M., U.S.N.M. and Genoa); Grotta de Isoverde, Liguria, 7 (B.M. and Genoa); Rimini, 2 (U.S.N.M.); Siena, 1 (U.S.N.M.); near Rome, 5 (U.S.N.M. and Genoa); no exact locality, 1; Sicily, 2.

Corsica: Commune di Barbaggio, 1.

Sardinia: Sassari, 1.

Greece: Parnassus region, 1 (U.S.N.M.); Island of Syra, Cyclades, 1 (U.S.N.M.); Mt. Goria Monastery, Crete, 3.

Germany: Tübingen, Würtemberg, 1.

Switzerland: Geneva, 6 (U.S.N.M. and Mottaz); Boudry, Neuchatel, 2 (Mottaz); Tremona, Ticino, 1; Mendrisio, Ticino, 2; Lugano, Ticino, 3.

Austria-Hungary: Herkulesbad, Hungary, 6; Ofener Mts., Hungary, 1.

Remarks.—Spanish specimens of *Rhinolophus ferrum-equinum* have been regarded by both Cabrera and Andersen at representing a peculiar race, *R. f. obscurus*, distinguished by small size. The material which I have examined, however, indicates that the Iberian animal cannot be treated as distinct.

♂.	Cintra, 500 mm. Portugal.	O. Thomas (C & P).	98. 2. 2. 1.
6 al.	Silos, Burgos, Spain.	N. & S. Gonzalez (C).	8. 7. 7. 38–43.
2 ♂, 2 ♀.	Silos, Burgos.	G. S. Miller (C).	8. 8. 4. 1–4.
♂, ♀.	Granada, 2250 ft.	G. S. Miller (C).	8. 8. 4. 8–9.
2 ♂, ♀.	Elche, Alicante, 20 m.	G. S. Miller (C).	8. 8. 4. 5–7.
♂, 2 ♀.	San Cristobal, Minorca, Balearic Islands.	O. Thomas and R. I. Pocock (C & P).	0. 7. 1. 24–26.
♂ al.	San Cristobal, Minorca.	O. Thomas and R. I. Pocock (C & P).	0. 7. 1. 68.
6 ♂.	Troubate, Hautes-Pyrénées, France. (*A. Robert.*)	O. Thomas (P).	6. 4. 1. 1–6.
1 al.	Meounes, Var.	Dr. K. Jordan (C & P).	8. 3. 15. 1.
♀ al.	Turin, Italy.	Prof. Bonelli (P).	——
♀ al.	Isoverde, Genoa.	O. Thomas (C & P).	88. 12. 7. 1.
Skeleton.	Italy. (*Prince Bonaparte.*)	Tomes Collection.	7. 1. 1. 727.
2 ♂ al.	Sicily.	——	——
♂ al.	Barbaggio, Corsica.	Dr. C. I. Forsyth Major (C & P).	6. 4. 14. 1.
♂ al.	Sassari, Sardinia.	Marquis G. Doria (P).	6. 12. 1. 11.
♂, 2 ♀.	Mt. Goria Monastery, Crete.	Miss D. Bate (C).	5. 12. 2. 1–3.
♀ al.	Tübingen, Würtemberg, Germany.	Dr. A. Günther (P).	66. 2. 1. 1.
♀.	Tremona, Ticino, Switzerland. (*E. H. Zollikofer.*)	O. Thomas (P).	2. 8. 4. 1.
2 ♂.	Mendrisio, Ticino. (*E. H. Zollikofer.*)	O. Thomas (P).	2. 8. 4. 2–3.
3.	Lugano, Ticino. (*E. H. Zollikofer.*)	O. Thomas (P).	4. 4. 5. 1–3.
2 ♂, 4 ♀.	Herkulesbad, Hungary.	Hon. N. C. Rothschild (P).	7. 9. 16. 1–6.
♀ al.	Ofener Mts., Budapest.	Budapest Museum (E).	94. 7. 18. 5.

Rhinolophus ferrum-equinum insulanus Barrett-Hamilton.

1910. *Rhinolophus ferrum-equinum insulanus* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 8th ser., v, p. 292, March, 1910. Type in British Museum.

1910. *Rhinolophus ferrum-equinum insulanus* Trouessart, Faune Mamm. d'Europe, p. 273.

Type locality. Cheddar, Somersetshire, England.

Geographical distribution.—Central and southern England.

Diagnosis.—Wing relatively short; forearm, 52 to 55; third finger, 83 to 88.

Measurements.—Type (adult male): head and body, 67; tail, 37; tibia, 23·4; foot, 11; **forearm**, 54; third finger, 86; fifth finger, 70; ear from meatus, 23·6. Average and extremes of seven males from the type locality: head and body, 65 (63–67); tail, 36·9 (35–40); tibia, 22·8 (22–24); foot, 11·2 (11–12); **forearm**, 53·5 (52–54); third finger, 85·5 (83–87); fifth finger, 69·9 (69–71); ear from meatus, 24·2 (23–25). Three females from the type locality: head and body, 64, 66 and 64; tail, 35, 34 and 36; tibia, 23·4, 23 and 23; foot, 10·6, 12 and 12; **forearm**, 55, 54·6 and 54; third finger, 87, 86 and 88; fifth finger, 72, 72 and 72; ear from meatus, 25, 24 and 24. For cranial measurements see Table, p. 144.

Specimens examined.—Twenty-four, from the following localities in England:—Cheddar, Somersetshire, 10; Wells, Somersetshire, 10; Dorsetshire, 3; Bonchurch, Isle of Wight, 1.

♂, ♀.	Cheddar, Somerset, England.	J. A. Coward (C & P).	7. 1. 10. 1–2.
6 al.	Cheddar.	J. A. Coward (C & P).	7. 1. 10. 3–10.
♂, 2 ♀ al.	Wells.	Hon. N. C. Rothschild (P).	5. 1. 23. 1–3.
3 ♂, ♂ juv., ♀ st.	Wells.	Hon. N. C. Rothschild (P).	1. 9. 3. 1–4. 2. 9. 6. 1.
♂, ♀.	Wells.	Hon. N. C. Rothschild (P).	11. 1. 3. 3–4.
2 ♀.	Dorset.	W. M. Hardy (C & P).	11. 1. 3. 1–2.
1.	Bonchurch, Isle of Wight.	Rev. C. A. Bury (C & P).	11. 1. 3. 388.

RHINOLOPHUS HIPPOSIDEROS Bechstein.

(Synonymy under subspecies.)

Geographical distribution.—From Gilgit through the Mediterranean sub-region and central Europe to Ireland; north in continental Europe to the Baltic, and in Great Britain to about the southern border of Scotland.

Diagnosis. Size small, the forearm less than 43 mm. in length, condylobasal length of skull about 14 to 15 mm., mandible about 10 mm.; noseleaf (fig. 26 *b*) with bluntly cuneate sella and low, broadly rounded connecting process; fourth finger with

first phalanx slightly more than half as long as second; large upper premolar separated from canine by a noticeable space occupied by the well developed small premolar, which lies perfectly in the tooth-row.

External characters.—A much smaller, more delicately formed animal than *Rhinolophus ferrum-equinum*. General outline of noseleaf narrower than in *R. ferrum-equinum*, the width of horseshoe less than distance from flat area at base of sella to tip of lancet; sella narrowly rounded at tip, the sides straight, slightly convergent above, the resulting outline bluntly cuneate; connecting process essentially as in the larger species but relatively wider and lower, its upper extremity about on level with that of sella; lancet slender, scarcely or not contracted at middle, the tip cuneate. Ear when laid forward extending about 5 mm. beyond extremity of muzzle, the narrow tip abruptly curved backward; antitragal lobe more than half as high as conch, its width less than its height, its upper margin noticeably oblique. Wings and feet essentially as in *R. ferrum-equinum*.

Colour.—The colour does not differ appreciably from that of *Rhinolophus ferrum-equinum*.

Skull.—The skull differs from that of *Rhinolophus ferrum-equinum* chiefly in its conspicuously smaller size (greatest length about 16 mm. instead of about 24 mm.). There are also some slight peculiarities in form, the principal of which is the greater contrast between width of brain-case and anterior maxillary region, the breadth of former being about twice that of latter. As the breadth of brain-case is contained distinctly less than $2\frac{1}{2}$ times in greatest length it is probable that the difference between the two animals is due rather to enlarged brain-case in the smaller than to widened palate in the larger. Sagittal crest slightly developed; lambdoid crest obsolete. Nasal region relatively more inflated than in *R. ferrum-equinum*, particularly at side of nares, but dorsal outline not rising abruptly above level of interorbital region. Mesopterygoid fossa so conspicuously widened anteriorly that it occupies almost entire extent of palate between posterior molars, leaving no space for lateral palatal emarginations, a peculiarity by which the skull may be distinguished from that of all other European members of the genus.

Teeth.—Though in general resembling those of *Rhinolophus ferrum-equinum*, apart from their much smaller size, the teeth of *R. hipposideros* show several notable peculiarities. Upper canine relatively small, its apex in line with large cusps of molars, and slightly below that of posterior premolar; lower canine correspondingly short; anterior upper premolar a well developed functional tooth lying perfectly in tooth-row, with crown area equal to nearly half that of canine, its shaft subtercte though flattened posteriorly, and only a little less than half as high as main cusp of large premolar: anterior and posterior lower pre-

molars less contrasted in size than in the larger animal, and separated from each other by a slight space in which lies the minute middle premolar, less crowded outward than in *R. ferrum-equinum*. Large upper premolar and upper molars essentially as in *R. ferrum-equinum* except that in m^3 there is a distinct metastyle and fourth commissure, and area of tooth is nearly equal to that of m^2. Lower molars as in *Rhinolophus ferrum-equinum*, except that in m_3, almost exactly resembles the other teeth, the second triangle having undergone practically no reduction.

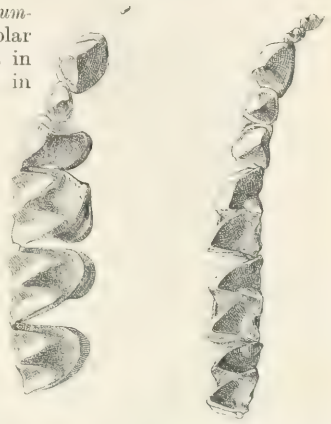

FIG. 28.

Rhinolophus hipposideros. Teeth × 10

Measurements.—Head and body about 40 mm., tail about 30 mm., **forearm**, 34·5 to 41·7 mm., condylobasal length of skull, 13·8 to 15 mm. (greatest length 14·5 to 16·2). Details under subspecies.

Remarks.—Three imperfectly differentiated forms of *Rhinolophus hipposideros* occur in Europe: a larger central race, a smaller Mediterranean race, and an intermediate form peculiar to Great Britain and Ireland. Without examination of much more complete material than that now available it is impossible to reach any wholly satisfactory conclusion as to the status and interrelationships of these forms. The characters here given are those published by Andersen in 1905.*

RHINOLOPHUS HIPPOSIDEROS HIPPOSIDEROS Bechstein

1789. *Vespertilio ferrum-equinum* B., Die kleine Hufeisennase, Bechstein. Gemeinn. Naturgesch. Deutschlands, I, 1st ed., p. 186.

1792. *Vesp[ertilio] fer[rum]-equ[inum] minor* Kerr, Anim. Kingd., p. 99 (not *V. molossus minor* Kerr, l.c., p. 97) (France).

1800. *Vespertilio hipposideros* Bechstein, Thomas Pennant's Allgemeine Uebersicht der vierfüssigen Thiere, II, p. 629.

1803. *Rhinolophus minor* Geoffroy, Catal. Mamm. Mus. Nat. d'Hist. Nat., Paris, p. 57 (Neighbourhood of Paris).

1813. *Rhinolophus bihastatus* Geoffroy, Ann. Mus. d'Hist. Nat., Paris, XX. p. 259 (Neighbourhood of Paris).

1816. ? *Phyllorhina minuta* Leach, Syst. Catal. Spec. Indig. Mamm. and Birds Brit. Mus., p. 5 (nomen nudum: "Small Leafnose").

* For further discussion of the subject see Mottaz, Mém. Soc. Zool. de France, Paris, XX, pp. 21–22, September, 1907; Andersen, Ann. and Mag. Nat. Hist., 7th ser., XX, pp. 384–389, November, 1907.

1829. ? *Rhinolophus bifer* Kaup, Entw.-Gesch. u. Natürl. Syst. Europ. Thierwelt, I, p. 104 (nomen nudum).

1857. ? *Rhinolophus hipposideros* Blasius, Säugethiere Deutschlands, p. 29.

1863. *Rhinolophus hipposideros* α var. *typus* Koch, Jahrb. des Vereins für Naturkunde im Herzogthum Nassau, XVIII, p. 530 (Wiesbaden).

1863. [*Rhinolophus hipposideros*] β var. *alpinus* Koch, Jahrb. des Vereins für Naturkunde im Herzogthum Nassau, XVIII, p. 530 (Alps).

1870. *Rhinolophus eggenhöffner* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LXI, Abth. I, p. 151 (MS. synonym of *bihastatus*).

1878. *Rhinolophus hipposideros* Dobson, Catal. Chiropt. Brit. Mus., p. 117.

1885. *Rhinolophus bihastatus* var. *kisnyiresiensis* Daday, Orvos-Természettudományi Értesitő, Kolozsvar, X, p. 274 (Kis-Nyires, Szolnok-Dobaka, Hungary).

1886. *Rhinolophus bihastatus* var. *kisnyiresiensis* Daday, Verhandl. u. Mittheilungen des Siebenbürgischen Vereins für Naturwissensch. in Hermannstadt, XXXVI, p. 80.

1887. *Rhinolophus hipposideros* var. *troglophilus* Daday, Értekezések a Természettudományok Köréből, Budapest, XVI, pt. 7, p. 8 (Renaming of *kisnyiresiensis*).

1904. *Rhinolophus euryale helvetica* Bretscher, Vierteljahrsschrift der Naturforsch. Gesellsch. in Zürich, XLIX, p. 256. See Mottaz, Bull. Soc. Zool., Genève, I., p. 172, 1908 (Baar, Zug, Switzerland).

1905. *Rhinolophus hipposiderus typicus* Andersen, Proc. Zool. Soc. London, 1905, II, p. 141, October 17, 1905.

1910. *Rhinolophus hipposiderus* Trouessart, Faune Mamm. d'Europe, p. 9.

Type locality. France.

Geographical distribution.—Central Europe, north of the Alps, east through Armenia and north-west Persia to the Himalayas.

Diagnosis.—Forearm* usually 39 to 41·7 mm.; greatest length of skull† about 16 mm.

Measurements.—Two males from Strass near Burgheim, Bavaria, Germany: tibia, 17 and 18·4; foot, 7·8 and 7·4; **forearm**, 38·8 and 39·2; third finger, 61 and 60; fifth finger, 54 and 53. Female from the same locality: tibia, 17·4; foot, 7·4; **forearm**, 38·8; third finger, 60; fifth finger, 53. The six following extremes of **forearms** of European specimens are given by Andersen (*l.c.* p. 142): N. Bulgaria (1), 39; Roumania (13), 39 to 41·2; Transsylvania (2), 40 to 41; S. Carpathians (1), 39·3; Schlangenbad, Nassau, Germany (2), 40 to 40·1; Strassburg, Germany (3), 39 to 40·1. Forty-nine males from the vicinity of Geneva, Switzerland (Mottaz collection),‡ 37·3 to 39. Thirty females from the same locality (Mottaz collection),‡ 38·5 to 40·6. Four males from the same locality (U.S.N.M.), 37 to 38·4 Six females from the same locality (U.S.N.M.), 37·4 to 40. Adult female from Dions, Gard, France (Mottaz collection), 40. For cranial measurements see Table, p. 152.

* Bases of metacarpals included.

† From back of occiput to front of canine.

‡ Measured by Chas. Mottaz (base of metacarpals included) and verified by Gerrit S. Miller.

Specimens examined.—One hundred and seventeen, from the following localities:—

FRANCE: Dions, Gard, 1 (Mottaz); St. Cergues, Haute-Savoie, 1.

GERMANY: Strass, near Burgheim, Bavaria, 3; Mainz, 1 (Strassburg); Bitsch, Alsace, 1 (Strassburg).

AUSTRIA-HUNGARY: Hatszeg, Hunyad, Hungary, 1.

SWITZERLAND: Near Geneva, 94 (B.M., U.S.N.M. and Mottaz); St. Moritz, 1; Thayngen, Schaffhausen, 2 (U.S.N.M.); Roggwil, Thurgau, 7 (B.M. and U.S.N.M.); Canton Thurgau, 5 (B.M. and U.S.N.M.).

♂.	St. Cergues, Haute-Savoie, France.	A. Robert (C & P).	5. 4. 9. 1.
2 ♀.	Burgheim, Bavaria, 375 m. Germany.	Lord Lilford (P).	11. 1. 1. 117–118.
♂.	Hatszeg, Hunyad, Transylvania.	C. G. Danford (C).	3. 11. 8. 1.
3 ♂.	Grand Pré, Geneva, Switzerland.	C. Mottaz (C & P).	6. 2. 6. 1–3.
1.	St. Moritz, Grisons.	Leon O. Galliard (C & P).	75. 9. 20. 3.
3 ♂, 2 ♀, imm.	Roggwil, Thurgau. (*E. H. Zollikofer.*)	O. Thomas (P).	2. 8. 4. 4–9.
♀ al.	Thurgau. (*E. H. Zollikofer.*)	O. Thomas (P).	2. 8. 4. 55.

RHINOLOPHUS HIPPOSIDEROS MINIMUS Heuglin.

1861. *Rhinolophus minimus* Heuglin, Nov. Act. Acad. Caes. Leop.-Carol., XXIX, Abhandl. VIII, p. 6 (articles separately paged) (Kérén, Abyssinia).

1863. [*Rhinolophus hipposideros*] γ var. *pallidus* Koch, Jahrb. des Vereins für Naturkunde im Herzogthum Nassau, XVIII, p. 531 (Mediterranean region).

1904. *Rhinolophus phasma* Cabrera, Mém. Soc. Españ. Hist. Nat., Madrid, II, p. 252 (Madrid, Spain).

1904. *Rh[inolophus] h[ipposiderus] minimus* Andersen, Ann. and Mag. Nat. Hist., 7th ser., XIV, p. 456, December, 1904.

1905. *Rhinolophus hipposiderus minimus* Andersen, Proc. Zool. Soc. London, 1905, II, p. 140, October 17, 1905.

1910. *Rhinolophus hipposiderus minimus* Trouessart, Faune Mamm. d'Europe, p. 10.

Type locality.—Kérén, Abyssinia.

Geographical distribution.—Mediterranean region.

Diagnosis.—Forearm usually 34·7 to 38 mm.; greatest length of skull, 14·5 to 15·5 mm.

Measurements.—The following measurements of **forearms** are given by Andersen (*l.c.* p. 141): Kérén (type), 36·3; Cyprus (6), 34·7 to 37·7; Malta (8), 36 to 37; Ostia, Italy (2), 35·7 to 36·8; Corsica (1), 37·7; Balearic Islands (7), 36·2 to 37·6; Seville, Spain (1), 37·7; Cintra, Portugal (1), 36·2. Specimens in U.S. National Museum: Ficuzza, Sicily (♀), 35·2; Rome (♂), 36·4; Siena (3 ♂), 36·8 to 38; Marseilles, France (♀), 38; Dions, Gard, France (♂), 34·8, (♀), 36·6. Two females from Ax-les-Thermes, Ariège, France, 36·6 and 38·4. Two males from Silos, Burgos, Spain, 36 and 37. Female from the same locality, 38. Five males from Ticino, Switzerland, 37·0 (36·2–38). Mottaz collection: St. Genies, Gard, France (15,

CRANIAL MEASUREMENTS OF *RHINOLOPHUS HIPPOSIDEROS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case at middle.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
R. hipposideros hipposideros.												
Germany: Strass, near Burgheim, Bavaria	152530	♀	15·0	7·8	1·8	3·8	6·8	4·8	10·2	5·4	5·8	Teeth slightly worn.
Schlangenbad, Nassau	66. 2. 1. 38		14·6±		1·8	3·8	6·8	4·2	10·0	5·4	5·8	,, not worn.
Hungary: Hatszeg, Hunyad	3. 11. 8. 1	♂	14·8	7·2	1·8	3·8	6·6	4·6	10·0	5·4	5·8	,, ,,
Switzerland: near Geneva	124388	♂	14·0	7·4	1·6	3·8	6·6	4·8	9·8	5·4	5·6	,, ,,
,, ,,	142587	♂	14·8	7·6	1·8	3·8	6·4	5·0	10·0	5·4	5·8	,, ,,
,, ,,	142588	♂	14·8	7·4	1·6	3·8	6·4	5·0	9·8	5·4	5·6	,, slightly worn.
,, ,,	142591	♂	15·2	7·2	1·8	3·6	6·8	5·0	10·0	5·2	5·6	,, not worn.
,, ,,	124389	♀	14·4	7·4	1·8	3·8	6·8	4·8	9·8	5·4	5·8	,, ,,
,, ,,	124390	♀	15·0	7·6	1·6	3·8	6·8	4·8	10·0	5·6	5·8	,, ,,
,, ,,	124391	♀	15·0	7·4	1·8	3·8	6·8	5·0	9·8	5·2	5·6	,, ,,
,, ,,	124392	♀	14·4	7·8	1·8	3·8	6·8	5·0	10·0	5·2	5·6	,, ,,
,, ,,	124394	♀	14·8	7·8	1·8	3·8	6·8	5·0	9·8	5·2	5·6	,, slightly worn.
R. hipposideros minutus.												
England: Devonshire	11. 1. 3. 8	♀	14·6	7·6	1·6	3·6	6·2	4·8	10·0	5·2	5·4	,, ,,
,,	11. 1. 3. 9	♀	14·6±	7·4	1·8	3·4	6·2	4·6	9·8	5·2	5·4	,, not worn.
Zeals, Wiltshire	4. 11. 6. 2	♀	15·0	7·8	1·6	3·8	6·4	5·0	9·8	5·4	5·6	,, slightly worn.
,, ,,	4. 11. 6. 1	♂	15·2	7·6	1·8	4·0	6·6	5·0	10·0	5·4	5·6	,, ,,
Somersetshire	5. 1. 24. 1	♂	15·0	7·4	1·6	3·8	6·8	5·0	9·8	5·2	5·4	,, ,,
Hope End, Herefordshire	10. 5. 23. 1	♂	15·0	7·6	1·6	3·8	6·8	4·8	10·0	5·4	5·6	,, ,,

R. hipposideros minimus.

Spain: Elche, Alicante	8. 8. 4. 12	♂	14·2	7·4	1·6	3·6	6·0	4·6	9·8	5·2	5·4	Teeth not worn.
„ „	172176	♂	14·6	7·4	1·6	3·6	6·2	4·6	10·0	5·4	5·6	„ slightly worn.
Silos, Burgos	172122	♂	14·8	7·8	1·6	3·6	6·2	4·8	10·0	5·4	5·4	„ not worn.
„ „	8. 8. 4. 11	♀	14·6	7·2	1·6	3·4	6·4	5·0	10·0	5·4	5·6	„ „
France: Ax-les-Thermes, Ariège	172121	♀	14·6	7·8	1·8	3·6	6·2	4·8	9·8	5·4	5·6	„ slightly worn.
„ „	8. 8. 4. 124	♀	15·0	8·0	1·8	3·6	6·6	4·8	10·0	5·2	5·4	„ much worn.
Marseilles	102468	♀	14·2	7·6	1·8	3·8	6·4	5·0	9·4	5·2	5·4	„ slightly worn.
Switzerland: Locarno, Ticino	121183	♂	14·4	7·6	1·8	3·6	6·4	5·0	9·8	5·2	5·6	„ „
„ „	121184	♂	14·6	7·6	1·8	3·6	6·4	5·0	9·6	5·4	5·6	„ not worn.
„ „	121185	♀	14·4	7·4	1·8	3·8	6·4	4·8	9·6	5·4	5·4	„ „
Italy: Genoa	38345	♂	14·8		1·8	3·6	6·4	5·0	9·6	5·2	5·4	„ „
„	38346	♂	14·6	7·4	1·6	3·6	6·4	5·0	9·6	5·2	5·6	„ slightly worn.
„	38347	♀	14·2	7·2	1·6	3·6	6·4	5·2	—	5·2	5·4	„ „
Faenza	38344	♂	14·2	7·4	1·8	3·6	6·4	5·0	9·6	5·4	5·6	„ not worn.
Siena	86589	♂	14·2	7·6	1·8	3·8	6·4	4·8	9·6	5·2	5·4	„ slightly worn.
Rome	152532	♂	14·4	—	1·6	3·6	6·4	5·0	9·4	5·2	5·4	„ not worn.
Sicily: Ficuzza	152527	♂	13·8	7·2	1·6	3·4	6·4	4·6	9·2	5·0	5·2	„ „

both sexes), 36·4 to 38·2); Sardinia (2 ♀), 37·4 to 37·8. For cranial measurements see Table, p. 153.

Specimens examined.—Eighty-one, from the following localities:—
Spain: Inca, Majorca, Balearic Islands, 1; San Cristobal, Minorca, Balearic Islands, 3; Elche, Alicante, 2; Silos, Burgos, 5; Seville, 1.
Portugal: Cintra, 1.
France: Ax-les-Thermes, Ariège, 5; St. Genies, Gard, 17 (U.S.N.M. and Mottaz); Marseilles, 1 (U.S.N.M.).
Switzerland: Locarno, Ticino, 4 (U.S.N.M.); Gordola, Ticino, 2 (U.S.N.M.); Minusio, Ticino, 6 (U.S.N.M.).
Italy: Liguria, 3 (U.S.N.M.); Siena, 3 (U.S.N.M.); Faenza, 1 (U.S.N.M.); Rome, 3; Ostia, Rome, 2; Ficuzza, Sicily, 6.
Sardinia: No exact locality, 2 (Mottaz); Zimmigas, Siliqua, 2.
Corsica: Dintorni di Patrimonio, 3; no exact locality, 1.
Malta: 7.

♀.	Inca, Majorca, Balearic Islands.	O. Thomas and R. I. Pocock (c & p).	0. 7. 1. 1–2.
♂, ♀.	San Cristobal, Minorca.	O. Thomas and R. I. Pocock (c & p).	0. 7. 1. 27–28.
1 al.	San Cristobal, Minorca.	O. Thomas and R. I. Pocock (c & p).	0. 7. 1. 69.
♀.	Silos, Burgos, Spain.	G. S. Miller (c).	8. 8. 4. 11.
♂.	Elche, Alicante, Spain.	G. S. Miller (c).	8. 8. 4. 12.
♂ al.	Cintra, 500 m. Portugal.	O. Thomas (c & p).	98. 2. 2. 57.
♂, ♀.	Ax-les-Thermes, Ariège, 2400 ft. France.	G. S. Miller (c).	8. 8. 4. 124–126.
♂.	Rome, 37 m. (*C. Coli.*)	G. Barrett-Hamilton (p).	11. 1. 2. 42.
2.	Ostia, Rome.	Dr. L. Sambon (c & p).	1. 1. 2. 5–6.
6 ♂.	Ficuzza, Sicily. (*L. Roberti.*)	O. Thomas (p).	6. 8. 4. 13–16. 8. 9. 1. 1–2.
♂, ♀ al.	Zimmigas, Siliqua, Sardinia. (*R. Meloni.*)	Marquis G. Doria (p).	6. 12. 1. 20–21.
3 ♂, 2 ♀.	Malta. (*J. Micalleff.*)	Lord Lilford (p).	11. 1. 1. 119–123.
2.	Malta.	Lord Lilford (p).	95. 3. 2. 1–2.

Rhinolophus hipposideros minutus Montagu.

1808. *Vespertilio minutus* Montagu, Trans. Linn. Soc. London, ix, p. 163.
1905. *Rhinolophus hipposiderus minutus* Andersen, Proc. Zool. Soc. London, 1905, ii, p. 142, October 17, 1905.
1910. *Rhinolophus hipposiderus minutus* Trouessart, Faune Mamm. d'Europe, p. 10.

Type locality.—Wiltshire, England.
Geographical distribution.—England and Ireland.
Diagnosis. Forearm, 36·3 to 39 mm.; greatest length of skull about 16 mm.
Measurements. **Forearm** in 30 English and Irish specimens measured by Andersen (*l.c.* p. 142), 37·6 (36·3 to 39). For cranial measurements see Table, p. 152.

Specimens examined.—Sixteen, from the following localities in England:—Great Grimsby, Lincolnshire, 1; Bowdon, Cheshire, 1; St. Asaph, Denbighshire, 3; Conway, Carnarvonshire, 1; Hope End, Herefordshire, 1; Wells, Somersetshire, 1; Devizes, Wiltshire, 1; Zeals, Wiltshire, 2; Devonshire, 2; Ragley House, Warwickshire, 3.

3 ♂.	St. Asaph, Denbighshire, Wales.	Charles Oldham (C & P).	11. 1. 3. 5–7.
1.	Conway, Carnarvonshire.	Sir W. Jardine (C & P).	60. 9. 17. 1.
♀.	Great Grimsby, Lincolnshire, England. (*Caton Haigh.*)	G. Barrett-Hamilton (P).	11. 1. 2. 98.
♂.	Bowdon, Cheshire. (*T. A. Coward.*)	G. Barrett-Hamilton (P).	11. 1. 2. 99.
♂ al.	Hope End, Herefordshire.	N. C. Hewitt (C & P).	———
♂ al.	Wells, Somerset.	S. Lewis (C & P).	5. 1. 24. 1.
1.	Devizes, Wiltshire.	J. E. Harting (C & P).	87. 2. 21. 1.
♂, ♀ al.	Zeals, Wiltshire.	F. Norgate (C & P).	4. 11. 6. 1–2.
2 ♀.	Devonshire.	Oxley Grabham (C & P).	11. 1. 3. 8–9.
3.	Ragley House, Warwickshire.	Tomes Collection.	7. 1. 1. 289–291.

RHINOLOPHUS EURYALE Blasius.

1853. *Rhinolophus euryale* Blasius, Wiegmann's Archiv für Naturgesch., 1853, I, p. 49 (Milan, Italy).

1857. *Rhinolophus euryale* Blasius, Säugethiere Deutschlands, p. 35.

1878. *Rhinolophus euryale* Dobson, Catal. Chiropt. Brit. Mus., p. 116.

1904. *E[uryalus] toscanus* Andersen and Matschie, Sitz.-Ber. Gesellsch. Naturforsch. Freunde, Berlin, p. 77 (Caverna di Parignano, Mt. Pisani, Italy).

1904. *E[uryalus] atlanticus* Andersen and Matschie, Sitz.-Ber. Gesellsch. Naturforsch. Freunde, Berlin, p. 77 (St. Paterne, Indre-et-Loire, France).

1904. *E[uryalus] cabreræ* Andersen and Matschie, Sitz.-Ber. Gesellsch. Naturforsch. Freunde, Berlin, p. 78 (Alcalá de Henares, Madrid, Spain).

1910. *Rhinolophus euryale, R. euryale atlanticus, R. euryale toscanus, R. euryale cabrerai* Trouessart, Faune Mamm. d'Europe, pp. 5–7.

Type locality.—Milan, Italy.

Geographical distribution.—Southern Europe from Portugal to Greece, north to Hungary and central France.

Diagnosis.—Size medium, forearm, 44·6 to 49, condylobasal length of skull, 16·4 to 18, mandible, 12 to 13, upper tooth-row 6·2 to 6·6; noseleaf with parallel-sided, bluntly rounded sella and high, sharply pointed connecting process, the lancet gradually narrowing to a bluntly cuneate tip; fourth finger with first phalanx slightly more than one-third as long as second (ratio about 38); large upper premolar separated from canine by a narrow space occupied by the much reduced small premolar.

External characters.—Size intermediate between that of the Greater and Lesser Horseshoes. General outline of noseleaf (fig. 26 *c*) about as in *Rhinolophus ferrum-equinum*; sella parallel sided, rounded off above, connecting process sharply linear-pointed, rising conspicuously above sella; lancet with slight constriction above middle, beyond which the tip narrows gradually to a bluntly cuneate point. Ear when laid forward extending about 5 mm. beyond extremity of muzzle, its tip less attenuate and less noticeably curved backward than in *Rhinolophus ferrum-equinum*

CRANIAL MEASUREMENTS OF *RHINOLOPHUS EURYALE*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Lachrymal breadth.	Breadth of brain-case above Zygomata.	Depth of brain-case (median).	Mandible.	Maxillary tooth-row (exclusive of incisor).	Mandibular tooth-row (exclusive of incisors).	Observations.
Hungary: Orsova	7. 9. 16. 7	♀	17·0	9·8	2·2	5·0	8·0	6·0	12·0	6·2	6·8	Teeth not worn.
Ofener Mts.	94. 7. 18. 2	♂	17·6	9·4	2·2	5·2	8·2	6·0	12·0	6·4	7·0	,, slightly worn.
,, ,,	94. 7. 18. 3	♂	—	9·8	2·1	5·2	8·6	6·0	12·2	6·6	7·0	,, not worn.
Dalmatia: Zara	11. 1. 1. 128	♀	17±	9·2	2·2	5·2	8·0	6·0	12·2	6·2	6·8	,, ,,
Greece: Missolungi	153595	♀	17·2	8·8	2·0	5·0	8·0	6·0	11·8	6·4	6·6	,, ,,
,,	153596	♀	17·0	9·0	2·2	5·2	8·2	5·8	11·6	6·2	6·6	,, ,,
Italy: Siena	85687	♂	17±	9·4	2·2	5·0	8·4	—	11·6	6·2	6·4	,, ,,
,,	85688	♀	17·0	9·2	2·1	5·0	8·4	5·8	11·8	6·2	6·6	,, ,,
Velletri, Rome	105790	♂	17·2	9·2	2·4	5·0	8·2	6·0	11·8	6·2	6·8	,, slightly worn.
,, ,,	105788	♀	17·0	9·2	2·2	5·0	8·2	6·0	11·6	6·4	6·8	,, not worn.
,, ,,	105789	♀	17·2	9·4	2·2	5·0	8·4	6·0	11·8	6·2	6·6	,, slightly worn.
,, ,,	105790	♀	16·8	9·2	2·2	5·0	8·2	5·8	11·6	6·2	6·6	,, not worn.
,, ,,	105792	♀	17·2	9·2	2·4	5·0	8·2	6·2	11·8	6·2	6·6	,, slightly worn.
Marsala, Sicily	6. 8. 4. 10	♂	17·0	9·4	2·4	5·0	8·0	6·0	11·8	6·4	6·8	,, not worn.
,, ,,	6. 8. 4. 11	♂	17·0	10·0	2·6	5·0	8·0	6·2	12·0	6·6	7·0	,, slightly worn.
Finalborgo, Liguria	540 Mottaz	♂	17·2	9·2	2·2	5·0	8·2	6·2	12·0	6·4	7·0	,, not worn.
,, ,,	551 ,,	♂	17·6	9·4	2·4	5·0	8·2	6·0	12·0	6·2	6·8	,, ,,
,, ,,	553 ,,	♂	17·4	9·6	2·4	5·0	8·2	6·0	12·0	6·4	7·0	,, slightly worn.
,, ,,	554 ,,	♂	17·2	9·2	2·2	5·0	8·2	6·0	12·0	6·4	7·0	,, not worn.
,, ,,	539 ,,	♀	17·8±	9·2	2·2	5·0	8·2	.	12·0	6·2	6·8	,, slightly worn.
,, ,,	552 ,,	♀	17·4	9·4	2·2	5·0	8·2	6·0	12·0	6·2	6·8	,, not worn.

Italy: Genoa	38339	♂	17±		2·4	5·2	—	—	11·8	6·4	7·0	Teeth moderately worn.
,,	38341	♂	16·8	9·2	2·2	5·2	8·6	6·4	12·0	6·2	6·8	,, slightly worn.
,,	38340	♀	16·6	9·2	2·2	5·2	8.2	6·2	11·8	6·2	6·8	,, not worn.
France: Gapeau River, Var	8. 3. 15. 4	♂	17·6	9·4	2·2	5·0	8·4	6·2	11·6	6·4	7·0	,, ,,
,, ,,	8. 3. 15. 5	♂	17·4	9·2	2·2	5·0	8·0	5·8	12·0	6·6	6·8	,, slightly worn.
,, ,,	8. 3. 15. 2	♀	17·0	9·4	2·2	5·0	8·2	6·0	12·0	6·2	6·6	,, ,,
,, ,,	8. 3. 15. 3	♀	17·2	9·2	2·2	5·0	8·2	6·0	12·0	6·4	6·6	,, not worn.
near Nimes, Gard	Hu. 418 Mottaz	♂	17·2	9·4	2·4	5·0	8·2	6·0	12·0	6·2	6·8	,, ,,
,, ,,	Hu. 437 Mottaz	♂	17±	9·0	2·2	5·0	8·0	—	11·6	6·2	6·6	,, ,,
,, ,,	Hu. 155 Mottaz	♀	16·4	9·0	2·2	5·0	8·0	6·0	11·8	6·2	6·6	,, ,,
,, ,,	Hu. 422 Mottaz	♀	17·2	9·2	2·2	5·0	7·8	5·8	11·6	6·2	6·4	,, slightly worn.
,, ,,	Hu. 427 Mottaz	♀	17·0	9·2	2·2	5·0	8·0	5·6	11·6	6·2	6·6	,, not worn.
,, ,,	Hu. 429 Mottaz	♀	16·8	9·0	2·2	5·0	8·0	5·8	11·4	6·2	6·4	,, ,,
,, ,,	Hu. 421 Mottaz		17·0	9·0	2·2	5·0	8·2	6·0	11·8	6·2	6·8	,, ,,
,, ,,	Hu. 435 Mottaz		17·2	9·2	2·4	5·0	8·2	6·2	12·0	6·4	6·8	,, ,,
,, ,,	Hu. 436 Mottaz		17·0	9·0	2·2	4·8	8·4	6·0	11·6	6·2	6·8	,, ,,
,, ,,	Hu. 439 Mottaz		17·2	9·2	2·2	5·0	8·2	5·8	12·0	6·2	6·6	,, ,,
St. Paterne, Indre-et-Loire	38351	♀	17·2	9·4	2·4	5·2	8·4	5·8	11·6	6·4	6·6	,, slightly worn.
Spain: near Madrid	5. 2. 3. 2	♂	17·2	9·4	2·2	5·0	8·4	6·0	12·0	6·2	6·8	,, ,,
Villalba, Lugo	94. 1. 1. 1	♀	17·4	9·6	2·2	5·0	8·6	5·8	12·0	6·4	6·6	,, not worn.
Portugal: Cintra	98. 2. 2. 2	♀	17·0	9·8	2·2	5·0	8·0	6·0	12·0	6·4	6·8	,, ,,
,,	98. 2. 2. 3	♀	17·2	9·6	2·2	5·0	8·0	5·8	12·0	6·2	6·8	,, slightly worn.

and *R. hipposideros* ; antitragal lobe about half as high as conch, its width about equal to its height. Wing peculiar in the shortening of the first phalanx of fourth finger to a little more than one-third that of second (average of 10 specimens from Gard, France : first phalanx, 6·6 mm. ; second phalanx, 17·4 mm. ; ratio of first to second, 38 +). Foot averaging slightly more than half as long as tibia.

Colour.—While essentially as in *Rhinolophus ferrum-equinum* and *R. hipposideros*, the colour usually differs slightly in the more evident contrast of the light area between ears and the more drabby general effect of underparts. Median region below occasionally rather paler than usual, sometimes nearly as in *R. mehelyi*.

Skull.—In both size (greatest length about 19 mm.) and form the skull is somewhat intermediate between that of *Rhinolophus ferrum-equinum* and *R. hipposideros*. It resembles or surpasses the latter in the breadth of brain-case relatively to narrow maxillary region, but more nearly agrees with the former in the nearly parallel-sided mesopterygoid space, the anterior border of which is separated from posterior molars by well defined palatal emarginations. The mesopterygoid space is, however, shorter in proportion to its width than in *R. ferrum-equinum*. Floor of brain-case between cochleæ less narrowed than in the preceding species. Nasal region slightly less inflated than in *R. hipposideros*, and inflated area relatively shorter, its posterior border rising abruptly above interorbital level.

Teeth.—In all respects the teeth closely resemble those of *Rhinolophus ferrum-equinum* (apart from their smaller size), except that the upper canine is relatively less robust, the anterior upper premolar is less reduced (its crown area about double that of upper incisor), and anterior lower premolar is less crowded between canine and posterior premolar.

Measurements.—For cranial and external measurements see Tables, pp. 156 and 160.

Specimens examined.—About 130, from the following localities :—

PORTUGAL : Cintra, 6.

SPAIN : Villalba, Lugo, 1 ; Madrid, 2 ; Silos, Burgos, 1.

FRANCE : St. Paterne, Indre-et-Loire, 3 (B.M. and U.S.N.M.) ; St. Genies, Gard, about 50 (Mottaz) ; Gapeau River, Var, 12.

ITALY : Near Genoa, 33 (B.M., U.S.N.M., Genoa, and Mottaz) ; Monte Pisanino, 2 ; Siena, 3 (U.S.N.M.) ; Rome, 2 ; Velletri, Rome, 5 (U.S.N.M.) ; Nicotera, Calabria, 1 ; Marsala, Sicily, 2.

SARDINIA : Mcunt Gennargentu, 3 (U.S.N.M.).

AUSTRIA-HUNGARY : Ofener Mountains, 2 ; Orsova, 1.

DALMATIA : Zara, 1.

GREECE : Missolungi, Acarnania, 2 (U.S.N.M.).

Remarks.—*Rhinolophus euryale* is so readily distinguishable from all the other European members of the genus, except *R. mehelyi*, as to require no special comparisons. From *R. mehelyi* it is most easily distinguished by the form of the lancet and

antitragus, together with its rather smaller size and usually darker colour. With the material at hand I am unable to recognize the local forms of this species described by Andersen and Matschie, as the alleged differences appear to be within the range of normal individual variation.

2 ♀.	Cintra, 500 m. Portugal.	O. Thomas (C & P).	98. 2. 2. 2-3.
2 ♂, 2 ♀ al.	Cintra, 500 m.	O. Thomas (C & P).	98. 2. 2. 53–56.
♀ al.	Villalba, Lugo, N.W. Spain.	Dr. V. L. Seoane (P).	94. 1. 1. 1.
♂, ♀ al.	Madrid.	A. Cabrera (P).	5. 2. 3. 1-2.
1 al.	St. Paterne, Indre-et-Loire, France.	Royal Army Medical College (P).	9. 1. 4. 9.
♀ al.	St. Paterne, Indre-et-Loire.	G. E. Dobson (P).	80. 12. 14. 3.
9 al.	Gapeau River, Var.	Dr. K. Jordan (C & P).	8. 3. 15. 2–10.
3 ♂, ♀ al.	Finalborgo, Liguria, Italy. (*A. Gagero.*)	Marquis G. Doria (P).	6. 12. 1. 14–17.
2 al.	Monte Pisanino, Liguria.	Lord Lilford (P).	73. 1. 8. 6.
2 ♂.	Rome. (*C. Coli.*)	G. Barrett-Hamilton (P).	11. 1. 2. 40–41.
♂ al.	Nicotera, Calabria.	Florence Museum (E).	85. 7. 6. 1.
2 ♂.	Marsala, Sicily. (*A. Robert.*)	O. Thomas (P).	6. 8. 4. 10–11.
♂, ♀ al.	Ofener Mts., Budapest.	Budapest Museum (E).	94. 7. 18. 2–3.
♀.	Orsova, Hungary.	Hon. W. Rothschild (P).	7. 9. 16. 7.
♀.	Zara, Dalmatia, 50 m. (*Kolombatovic.*)	Lord Lilford (P).	11. 1. 1. 128.
1 al.	S. Europe.	Purchased (Parreys).	47. 5. 27. 44.

RHINOLOPHUS MEHELYI Matschie.

1901. *Rhinolophus mehelyi* Matschie, Sitz.-Ber. Gesellsch. Naturforsch. Freunde, Berlin, p. 225 (Bucharest, Roumania).

1904. *Rhinolophus carpetanus* Cabrera, Mem. Soc. Españ. Hist. Nat., II, p. 254 (Madrid, Spain).

1910. *Rhinolophus euryale mehelyi* and *R. carpetanus* Trouessart, Faune Mamm. d'Europe, pp. 7–8.

Type locality.—Bucharest, Roumania.

Geographical distribution.—Roumania, southern France (Gard), Sardinia, central Spain. Details of distribution not known.

Diagnosis.—Like *Rhinolophus euryale* but larger (forearm, 48·6 to 51·4; upper tooth-row about 7 mm.); noseleaf with lancet abruptly narrowed to a linear tip; ear with antitragal lobe relatively broad and low; fourth finger with first phalanx decidedly more than one-third as long as second (ratio about 44); colour usually paler than in the related animal.

External characters. Slightly larger and more robust than *Rhinolophus euryale*, a difference especially noticeable in freshly killed individuals. Noseleaf as in *R. euryale*, except that the lancet is very abruptly narrowed above middle to a distinctly linear tip. Ear as in *R. euryale* but broader, the antitragal lobe

EXTERNAL MEASUREMENTS OF *RHINOLOPHUS EURYALE* AND *R. MEHELYI*.

Locality.	Number.	Sex.	Head and body.	Tail.	Tibia.	Foot.	Forearm.	Thumb.	Third finger.	Fifth finger.	Ear from meatus.	Ear from crown.	Width of ear.	First phalanx of fourth finger.	Second phalanx of fourth finger.
R. euryale.															
Portugal: Cintra	98. 2. 2. 53	♂	45·0	25·0	19·6	9·0	45·4	7·4	73	56	22·0	17·0	16·0	6·6	18·0
,, ,,	98. 2. 2. 54	♂	44·0	25·0	18·4	9·0	45·6	7·4	72	55	22·0	17·4	16·0	6·6	17·0
,, ,,	98. 2. 2. 55	♀	46·0	23·0	18·6	8·6	46·2	7·2	72	57	21·0	17·2	16·4	6·4	17·0
,, ,,	98. 2. 2. 56	♀	44·0	22·0	19·0	9·0	46·0	7·4	73	57	21·6	18·0	16·0	6·8	18·0
Spain: near Madrid	5. 2. 3. 2	♂	53·0	27·0	18·8	9·6	47·0	7·2	78	61	22·0	18·0	16·2	7·2	17·2
Villalba, Lugo	94. 1. 1. 1	♀	49·0	27·0	20·0	9·8	48·6	8·2	79	63	21·4	17·0	16·2	7·0	19·0
France: St. Paterne, Indre-et-Loire	80. 12. 14. 3	♀	43·0	23·0	19·0	9·8	48·2	8·0	78	62	20·0	17·0	15·6	6·8	17·2
,, ,,	144535	♀	50·0	27·0	19·0	9·8	48·0	8·0	71	60	20·0	17·0	17·0	6·6	18·0
St. Genies, Gard	Hu. 238 Mottaz	♀	54·0	24·0	19·8	9·8	48·4	7·2	77	61	21·4	19·0	15·6	7·0	18·4
,, ,,	Hu. 241 Mottaz	♀	25·0	22·4	20·0	9·0	48·0	7·0	75	60	21·0	17·6	16·0	7·0	18·0
,, ,,	Hu. 410 Mottaz	♂	55·0	23·0	19·0	10·0	46·4	6·6	73	58	22·0	20·4	17·0	6·6	17·6
,, ,,	Hu. 418 Mottaz	♂	54·0	23·4	18·4	10·0	47·6	7·2	76	59	22·0	19·6	16·4	6·6	18·2
,, ,,	Hu. 438 Mottaz	♀	55·0	26·0	20·4	11·0	49·0	7·2	78	62	22·0	19·0	16·2	7·4	19·6
,, ,,	Hu. 443 Mottaz	♀	56·0	24·0	20·0	10·6	47·6	7·6	76	60	22·0	20·2	16·2	7·0	19·0
Gapeau River, Var.	8. 3. 15. 2	♀	46·0	23·0	19·0	9·0	47·6	8·6	74	61	21·0	18·0	16·0	7·2	16·8
,, ,,	8. 3. 15. 3	♀	50·0	23·0	19·4	9·0	46·4	7·4	74	59	21·0	18·6	16·0	6·4	17·0
,, ,,	8. 3. 15. 1	♂	48·6	27·0	18·6	9·6	47·4	6·8	76	60	23·0	18·0	17·0	6·6	17·6
,, ,,	8. 3. 15. 5	♂	52·0	23·4	19·6	9·8	48·0	8·0	78	61	20·0	19·2	17·0	6·8	18·0

Italy: Finalborgo, Liguria .	6. 12. 1. 14	♂	45·0	25·0	20·4	10·0	48·0	7 6	76	59	21·6	18·6	16·0	6·8	17·6
„ „ .	6. 12. 1. 15	♂	46·0	24·0	20·0	9·8	48·0	8·6	75	59	21·0	19·0	15·6	6·6	17·4
„ „ .	6. 12. 1. 16	♂	44·0	25·2	20·0	9·6	48·0	9·0	77	61	21·4	18·2	16·4	6·6	17·0
„ „ .	6. 12. 1. 17	♀	46·0	26·0	20·0	9·8	47·4	7·6	77	62	21·0	18·2	16·0	6·8	17·8
„ „ .	539 Mottaz	♀	—	28·0	20·0	9·4	48·4	8·0	76	60	—	—	—	7·0	18 0
„ „ .	552 Mottaz	♀	—	25·0	18·6	9·0	47·6	7·4	76	57	—	—	—	6·6	18·0
Dalmatia: Zara . .	11. 1. 1. 128	♀	—	—	—	9·0	48·6	7·0	76	60	—	—	—	7·0	18·0
Austria-Hungary: Ofener Mts.	94. 7. 18. 2	♂	50·0	24·0	21·0	9·0	47·8	7·0	75	62	22·0	18·2	16·0	6·8	17·8
„ „	94. 7. 18. 3	♀	55·0	25·0	20·0	10·2	48·6	8·0	78	63	21·4	18·4	16·0	6·6	17·8
Orsova .	7. 9. 16. 7	♀	58·0	30·0	20·0	9·2	47·0	8·0	76	59	—	—	—	7·0	18·4
Greece: Missolungi, Acarania.	153595	♀	—	—	18·8	9·8	46·0	7·0	73	—	—	—	—	8·0	15·8
„ „	153596	♀	—	—	19·0	9·2	45·0	7·0	68	—		—	—	7·2	17·0
R. mehelyi.															
Spain: Madrid . . .	5. 2. 3. 1*	♀	56·0	27·6	21·0	11·0	51·0	9·0	82	61	23·0	19·0	16·0	8·0	18·0
France: St. Genies, Gard .	Hu. 111 Mottaz	♂	60·0	24·0	21·4	9·0	50·4	7·4	82	64	23·6	19·0	16·0	8·0	18·0
„ „ .	Hu. 242 Mottaz	♀	58·0	26·0	22·0	10·0	51·0	7·2	80	63	23·0	18·6	16·0	7·6	18·0
„ „ .	Hu. 415 Mottaz	♂	64·0	26·4	22·0	12·0	50·6	9·0	81	—	23·4	19·6	16·0	8·0	18·0
„ „ .	Hu. 433 Mottaz	♂	61·0	27·0	22·0	12·2	51·4	8·8	81	—	21·0	21·0	16·6	8·0	18·4
„ „ .	Hu. 414 Mottaz	♀	60·0	25·0	21·0	11·4	49·6	8·8	80		23·4	21·6	15·6	7·6	17·4
„ „ .	Hu. 434 Mottaz	♀	61·0	25·0	21·4	12·6	51·2	8·8	83	—	23·4	22·0	16·4	8·0	18·4
Sardinia: Sassari . .	6. 12. 1. 18	♂	51·0	25·0	21·0	10·0	48·8	8·6	81	63	22·0	18·4	15·6	7·6	18·0
„ . . .	6. 12. 1. 19	♂	53·0	23·0	20·0	10·0	49·0	8·0	80	63	22·0	18·0	16·4	7·2	17·4
„ . . .	86536	♂	62·0	24·0	21·0	11·4	49·0	9·0	81	62	22·6	18·0	16·4	7·4	17·6
Roumania: Bucharest . .	122133		—	—	21·6	11·2	50·0	8·0	84	59	—	—	—	8·0	18·8
Dobrudscha. .	Mottaz	♀	57·4	25·0	21·8	11·0	51·0	8·6	86	—	23·0	20·0	16·4	8·0	19·0

* Paratype of *carpetanus* Cabrera.

scarcely half as high as conch, its width slightly greater than height. Wing differing from that of the related animal in the less degree of shortening of the first phalanx of fourth finger as compared with second (average of ten specimens from Gard, France, first phalanx, 8·1 ; second phalanx, 18·0 ; ratio of first to second, 44 +). Foot as in *R. euryale*.

Colour.—Though not invariably distinguishable the colour is usually paler than that of *Rhinolophus euryale*, a difference especially noticeable in the region between ears, on sides of face and neck, on chin and throat, and along median portion of chest and belly, all of which are frequently a very pale almost whitish drab-grey.*

Skull and teeth.—Except for its slightly greater average size (greatest length about 20 mm.) the skull agrees with that of *Rhinolophus euryale*. Teeth more robust than those of the related animal, but not peculiar in form.

Measurements.—For external and cranial measurements see Tables, pp. 161, 163.

Specimens examined.—About fifty-five, from the following localities :—
Spain : Near Madrid, 1 (paratype of *carpetanus*).
France : Near St. Genies, Gard, about 50, skins and in flesh (Mottaz).
Sardinia : Sassari, 3 (B.M. and U.S.N.M.).
Roumania : Bucharest, 1 (U.S.N.M.) ; Dobrudscha, 1 (Mottaz).

Remarks.—At first sight this species appears very similar to *Rhinolophus euryale*, together with which it occurs ; but its characters when once understood are readily appreciable. The ranges of the two animals will probably be found to be essentially coincident, though *Rhinolophus mehelyi* may prove to be more strictly confined to the Mediterranean region than the smaller form.

♀.	Madrid.	A. Cabrera (P.)	5. 2. 3. 1. (Paratype of *R. carpetanus* Cabrera.)
2 ♂ al.	Sassari, Sardinia.	Marquis G. Doria (P).	6. 12. 1. 18–19.

RHINOLOPHUS BLASII Peters.

1857. *Rhinolophus clivosus* Blasius, Säugethiere Deutschlands, p. 33. Not of Rüppell, 1824 (Italy, Sicily, Istria and Dalmatia).
1866. *Rhinolophus blasii* Peters, Monatsber. k. Akad. Wissensch. Berlin, p. 17 (Renaming of *clivosus* Blasius).
1878. *Rhinolophus blasii* Dobson, Catal. Chiropt. Brit. Mus., p. 117.
1910. *Rhinolophus blasiusi* Trouessart, Faune Mamm. d'Europe, p. 9.

Type locality.—South-eastern Europe.

Geographical distribution.—Eastern portion of the Mediterranean region : Cyprus, Greece, Italy?

Diagnosis.—Size essentially as in *Rhinolophus euryale ;* nose-

* When seen by candle-light flying in caverns these bats are said to appear entirely white.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Lachrymal breadth.	Breadth of brain-case above zygomata.	Depth of brain-case (median).	Mandible.	Maxillary tooth-row (exclusive of incisor).	Mandibular tooth-row (exclusive of incisors).	Observations.
R. mehelyi.												
Roumania: Dobrudscha .	Mottaz	♀	18·0	10·6	2·6	5·2	8·8	—	13·0	6·8	7·2	Teeth not worn.
Bucharest .	122133		17·6	10·4	2·6	5·2	8·8	6·0	12·6	6·8	7·0	,, ,,
Sardinia: Sassari . .	* 6. 12. 1. 18	♂	17·8	10·0	2·6	5·2	9·0	6·0	12·8	7·0	7·4	,, ,,
,, . .	6. 12. 1. 19	♂	18·0	10·0	2·6	5·4	9·2	6·0	13·0	7·0	7·2	,, slightly worn.
,, . .	86536	♂	17·8	10·0	2·6	5·4	9·0	6·0	12·6	7·0	7·2	,, moderately worn.
France: near Nîmes, Gard	Hu. 143 Mottaz	♂	17·8	10·0	2·4	5·2	8·6	6·0	12·8	6·8	7·2	,, not worn.
,, ,,	,, 144 ,,	♂	17·4	9·8	2·6	5·2	8·6	6·2	12·8	6·8	7·2	,, ,,
,, ,,	,, 145 ,,	♂	17·4	10·2	2·6	5·2	9·0	6·0	12·6	7·0	7·2	,, ,,
,, ,,	,, 149 ,,	♀	17·6	10·4	2·6	5·2	8·8	6·2	12·6	7·0	7·2	,, slightly worn.
,, ,,	,, 151 ,,	♀	17·6	10·2	2·6	5·2	8·6	6·0	12·4	6·8	7·2	,, not worn.
,, ,,	,, 415 ,,		18·0	10·4	2·6	5·2	8·8	6·2	12·8	7·0	7·4	,, ,,
,, ,,	,, 444 ,,		17·6	10·2	2·6	5·2	8·6	6·2	12·6	6·8	7·2	,, ,,
,, ,,	,, 146 ,,	♂	17·8	10·2	2·6	5·2	9·0	6·0	12·6	6·8	7·2	,, ,,
,, ,,	,, 152 ,,		18·0	10·2	2·6	5·2	9·0	6·0	12·8	7·0	7·2	,, slightly worn.
,, ,,	,, 433 ,,		18±	10·0	2·6	5·2	8·6	5·8	12·6	6·8	7·2	,, ,,
Spain: near Madrid .	5. 2. 3. 1*	♀	17·8	10·4	2·6	5·4	9·0	6·0	12·8	7·0	2·2	,, ,,
R. blasii.												
Cyprus	94. 12. 1. 1	♀	17·6	9·0	2·0	5·0	8·0	5·8	11·8	6·8	7·0	,, ,,
,, ...	94. 12. 1. 4	♀	17·4	9·0	2·2	5·0	8·0	6·0	11·8	6·8	7·0	,, ,,
Greece: Nauplia . .	37508		—	—	2·2	5·0	8±	—	12·0	6·8	7·0	,, not worn.

* Topotype of *carpetanus* Cabrera.

leaf with cuneate sella and very high, sharply pointed connecting process; fourth finger with first phalanx more than half as long as second; no marked contrast between crown areas of anterior and posterior lower premolars, a character unique among the European members of the genus.

Colour. The only skin of this species which I have examined is in bad condition. It indicates that the colour is not essentially different from that of *Rhinolophus euryale*.

Skull.—In general the skull resembles that of *Rhinolophus euryale*, with which it agrees in size and in the form of the nasal swellings as well as in that of mesopterygoid fossa and posterior portion of palate. Constriction at front of interparietal more pronounced than in any of the other European species, noticeably marking off the occipital region from rest of brain-case.

Teeth.—Incisors, canines and molars as in *Rhinolophus euryale*. Small upper premolar slightly less reduced, perfectly in the tooth-row, but showing no tendency to develop a cusp. Large upper premolar with anterior and posterior margins of crown essentially parallel, the posterior border nearly straight. Lower premolars differing from those of all the other European members of the genus in the approximately equal crown areas of the two larger teeth, the anterior subterete, the posterior with trapeziform section; shaft of posterior tooth with diameter in axis of tooth-row much less than transverse diameter, the cusp when viewed from the side appearing to rise from middle of crown with noticeable flat area before and behind it.

Measurements.—Average and extremes of four females from Cyprus: head and body, 48·4 (44–51); tail, 24·7 (24–25); tibia, 19·3 (19–20); foot, 9·7 (9·4–10); **forearm**, 45·3 (44·6–47); thumb, 7·5 (7–8); third finger, 70·3 (69–72); fifth finger, 57·7 (56–60); ear from meatus, 19·7 (19–20); ear from crown, 15·5 (15–16·4); width of ear, 14·7 (14–15). Adult from Nauplia, Greece: tibia, 18·8; foot, 9·6; **forearm**, 44·6; thumb, 8; third finger, 69; fifth finger, 57. For cranial measurements see Table, p. 163.

Specimens examined.—Five, from the following localities:—
Cyprus: No exact locality, 4.
Greece: Nauplia, 1 (U.S.N.M.).

Remarks.—This species is so readily distinguished from the other European members of the genus by the peculiarities of its noseleaf and lower premolar as to require no special comparisons. Its range appears to be strictly confined to the eastern portion of the Mediterranean region, not extending west of Italy.

Family VESPERTILIONIDÆ.

1821. *Vespertilionidæ* Gray, London Med. Repos., xv, p. 299, April 1, 1821 (part).

1857. *Vespertiliones* Blasius, Säugethiere Deutschlands, p. 37.

1878. *Vespertilionidæ* Dobson, Catal. Chiropt. Brit. Mus., p. 167 (except the genera *Natalus* and *Thyroptera*).

1907. *Vespertilionidæ* Miller, Families and Genera of Bats, p. 195, June 29, 1907.

Geographical distribution.—Eastern and western hemispheres to the limits of tree growth; in the Atlantic to the Azores, and in the Pacific to the Galapagos and Hawaiian Islands from America, and to Australia, New Zealand and Samoa from Asia.

Characters.—Ear with tragus; muzzle without distinct leaf-like outgrowths; skull with premaxillaries represented by nasal branches only, the two bones very early fused with surrounding parts; median length of palate greater than least distance between tooth-rows; auditory bulla not emarginated on inner side; shoulder girdle normal, without fusion of its elements; secondary articulation of humerus with scapula better developed than in the *Rhinolophidæ*; fibula very slender, not adding appreciably to strength of leg; foot normal, the toes slender; tail not projecting conspicuously beyond membrane.

Remarks.—This family is the most widely distributed group of bats as well as one of the richest in genera and species. Forty-one genera are at present known, eight of which occur in Europe.*

Sub-Family VESPERTILIONINÆ.

1878. *Vespertiliones* Dobson, Catal. Chiropt. Brit. Mus., p. 168 (except genera *Kerivoula* and *Harpiocephalus*).

1907. *Vespertilioninæ* Miller, Families and Genera of Bats, p. 197, June 29, 1907.

Geographical distribution. Same as that of the family *Vespertilionidæ*.

Characters.—Sternum slender, its entire length considerably more than twice greatest width of presternum; median lobe very much smaller than body of presternum; six ribs connected with sternum; seventh cervical vertebra not fused with first

* The American *Nycteris cinerea* has been recorded (under the name *Vespertilio pruinosus*) from South Ronaldshay, Orkney Islands, but the occurrence seems open to question (see Wolley, The Zoologist, vii, p. 2343, 1849; viii, pp. 2695-96, 2813-14, 1850; Barrett-Hamilton, Hist. Brit. Mamm., i, pp. 222–224, March, 1911).

A specimen of another North American member of this genus (*N. borealis*), bearing the label: "Villevêque (Maine & Loire), 8. 1. 89," is figured by Trouessart in Bull. Soc. Zool. de France, xxx, p. 152, 1905. This is copied, with change of locality from Maryland to France, from a figure published in Bull. U.S. Nat. Mus., No. 39, pt. N, 1899 and 1901. Though intended merely as a guide in preparing specimens, Dr. Trouessart's publication might be misinterpreted as a French record of the species.

dorsal; scapula with coracoid curved outward; nostrils simple; lower incisors in all known genera, 3–3.

Remarks.—The sub-family *Vespertilioninæ* contains all but eight of the known genera of *Vespertilionidæ*, and all but one, *Miniopterus*, of the eight found in Europe. It is the central, least specialized portion of the family.

KEY TO THE EUROPEAN GENERA OF *VESPERTILIONIDÆ*.

Cheek teeth $\frac{6-6}{6-6}$ ..... *Myotis*, p. 166.
Cheek teeth less than $\frac{6-6}{6-6}$.
  Upper premolars 1–1.
    Rostrum noticeably concave on each side of middle line; nares extending about halfway to interorbital constriction; palatal emargination broader than deep..... *Vespertilio*, p. 238.
    Rostrum evenly convex laterally; nares not extending halfway to interorbital constriction; palatal emargination deeper than broad..... *Eptesicus*, p. 224.
  Upper premolars 2–2.
    Lower premolars 3–3.
      Auditory bulla large, its greatest diameter more than twice width of basioccipital; ear much longer than head; second phalanx of third finger shorter than first *Plecotus*, p. 256.
      Auditory bulla small, its greatest diameter about equal to width of basioccipital; ear shorter than head; second phalanx of third finger nearly three times as long as first..... *Miniopterus*, p. 268.
    Lower premolars 2–2.
      Fifth finger shortened, its length only a little more than that of metacarpal of fourth or third..... *Nyctalus*, p. 242.
      Fifth finger normal, its length greater than that of metacarpal and first phalanx of fourth or third.
        Upper surface of rostrum convex; ears separate..... *Pipistrellus*, p. 202.
        Upper surface of rostrum concave; ears joined..... *Barbastella*, p. 263.

Genus **MYOTIS** Kaup.

1829. *Myotis* Kaup, Entw.-Gesch. u. Natürl. Syst. Europ. Thierwelt, I, p. 106 (*myotis*).
1829. *Nystactes* Kaup, Entw.-Gesch. u. Natürl. Syst. Europ. Thierwelt, I, p. 108 (*bechsteinii*).
1830. *Leuconoe* Boie, Isis, p. 256 (*daubentonii*).
1839. *Vespertilio* Keyserling and Blasius, Wiegmann's Archiv für Naturgesch., 1839, I, p. 306 (Not *Vespertilio* Linnæus, 1758).
1841. *Selysius* Bonaparte, Iconogr. Faun. Ital. I., Introd. alla Classe Mamm., p. 3 (*mystacinus*).
1841. *Capaccinius* Bonaparte, Iconogr., Fauna Ital., I, Indice Distrib., p. 1 (*capaccinii*).
1842. *Trilatitus* Gray, Ann. and Mag. Nat. Hist., X, p. 258, December, 1842 (*hasseltii*, *macellus* = *adversus* and *blepotis*).

1849. *Tralatitus* Gervais, Dict. Univ. d'Hist. Nat., XIII, p. 213 (Modification of *Trilatitus*).

1856. *Brachyotus* Kolenati, Allgem. deutsch. Naturhist. Zeitung, Dresden, neue Folge, II, p. 131 (*mystacinus*, *daubentonii*, and *dasycneme*). Not *Brachyotus* Gould, 1837.

1856. *Isotus* Kolenati, Allgem. deutsch. Naturhist. Zeitung, Dresden, neue Folge, II, p. 131 (*nattereri* and *emarginatus*).

1857. *Vespertilio* Blasius, Säugethiere Deutschlands, p. 78. Not *Vespertilio* Linnæus, 1758.

1866. *Tralatitius* Gray, Ann. and Mag. Nat. Hist., 3rd ser., XVII, p. 90, February 1866 (Modification of *Trilatitus*).

1867. *Pternopterus* Peters, Monatsber. k. preuss. Akad. Wissensch. Berlin, p. 706 (sub-genus of *Vespertilio* = *Myotis*, type *lobipes* = *muricola*).

1870. *Exochurus* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LXII, p. 75 (*macrodactylus*, *horsfieldii* = *adversus* and *macrotarsus*).

1870. *Aeorestes* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LXII, p. 427 (*villosissimus*, *albescens*, and *nigricans*).

1870. *Comastes* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LXII, p. 565 (*capaccinii*, *megapodius*, *dasyneme*, and *limnophilus*).

1878. *Vespertilio* Dobson, Catal. Chiropt. Brit. Mus., p. 284. Not *Vespertilio* Linnæus, 1758.

1897. *Myotis* Miller, Ann. and Mag. Nat. Hist., 6th ser., XX, p. 382, October, 1897.

1899. *Euvespertilio* Acloque, Faune de France, Mammifères, p. 38 (*emarginatus*, *mystacinus*, *murinus* = *myotis*, *nattereri*, and *bechsteinii*).

1907. *Myotis* Miller, Families and Genera of Bats, p. 201, June 29, 1907.

Type species.—*Vespertilio myotis* Borkhausen.

Geographical distribution.—Entire mainland of Eastern and Western hemispheres to limits of tree growth ; also the Malay Archipelago, New Guinea, Australia and Samoa, and in America the Lesser Antilles.

Characters.—Dental formula : $i\ \frac{2\ 2}{3\ 3}$, $c\ \frac{1\text{-}1}{1\text{-}1}$, $pm\ \frac{3\text{-}3}{3\ 3}$, $m\ \frac{3\ 3}{3\text{-}3} = 38$. General form slender and delicate, even in such large species as *M. myotis*, the skull slender and lightly built ; muzzle narrow ; ear narrow and rather long, without special peculiarities of form, the tragus at least half as high as conch, straight or slightly curved, tapering gradually to a narrow or acute point.

Remarks.—The genus *Myotis* is the most widely distributed of the genera of bats. It is also probably the richest in species, though these are at present so imperfectly known that no estimate of their number can be made. Nine occur in Europe. These present considerable differences in size, ranging from nearly the smallest to nearly the largest members of the group ; they also differ considerably among themselves in certain details of structure, notably in the relative size of the hind foot ; but all are recognizable, apart from their dental formula, by a certain slenderness and delicacy of form, especially noticeable in the muzzle, ear, tragus and skull.

KEY TO THE EUROPEAN SPECIES OF *MYOTIS*.

Size large (forearm 53 to 64 mm., condylobasal length of skull 18·6 to 23·6 mm., upper tooth-row 8·2 to 10·6 mm.); middle upper premolar normally crowded inward from axis of tooth-row; third lower molar with second triangle much smaller than first and noticeably different from it in form.

Condylobasal length of skull 22 to 23·6 mm.; mandible 17·8 to 19 mm.; maxillary tooth-row 9·8 to 10·6 mm. (Central and southern Europe)..... *M. myotis*, p. 192.

Condylobasal length of skull 18·6 to 21·4 mm.; mandible 15·2 to 17·2 mm.; maxillary tooth-row 8·2 to 9·4 mm. (Mediterranean region) *M. oxygnathus*, p. 199.

Size small or medium (forearm 34 to 47 mm., condylobasal length of skull 12·4 to 16·8 mm., upper tooth-row 5 to 7 mm.); middle upper premolar not crowded inward from axis of tooth-row; third lower molar with second triangle nearly as large as first and essentially like it in form.

Foot relatively large, obviously more than half as long as tibia; calcar about twice as long as free border of interfemoral membrane; skull broad, the width of brain-case more than half greatest length; crown area of molars relatively small; upper molars with evident protoconule.

Forearm about 47 mm.; condylobasal length of skull about 16 mm. (Central and southern Europe) ..... *M. dasycneme*, p. 189.

Forearm less than 45 mm.; condylobasal length of skull never more than 15 mm.

Tibia and adjacent membrane densely furred; forearm about 42 mm.; condylobasal length of skull 14·0 to 14·8 mm. (Mediterranean region)..... *M. capaccinii*, p. 187.

Tibia and adjacent membrane not furred; forearm about 35 mm.; condylobasal length of skull 13·2 to 13·8 mm. (Distribution general)..... *M. daubentonii*, p. 184.

Foot relatively small, about half as long as tibia; calcar about as long as free border of interfemoral membrane; skull narrow, the width of brain-case less than half greatest length; crown area of molars relatively large; upper molars without protoconule.

Ear not specially elongated, extending slightly beyond nostril when laid forward.

Forearm about 40 mm.; condylobasal length of skull about 15 mm.; posterior border of ear conch with deep, almost angular emargination slightly above middle..... *M. emarginatus*, p. 177.

Forearm about 34 mm.; condylobasal length of skull 12·6 to 13·2 mm.; posterior border of ear conch with shallow, inconspicuous emargination ..... *M. mystacinus*, p. 169.

Ear elongated, extending conspicuously beyond nostril when laid forward.

Combined length of tibia and foot less than 25 mm.; condylobasal length of skull 14·0 to 14·6 mm.; ear narrow, its width about 10 mm.; tragus conspicuously more than half as high as conch..... *M. nattereri*, p. 174.

Combined length of tibia and foot about 30 mm.; condylobasal length of skull 16 to 17 mm.; ear broad, its width about 14 mm.; tragus scarcely half as high as conch..... *M. bechsteinii*, p. 179.

MYOTIS MYSTACINUS Kuhl.

1819. *Vespertilio mystacinus* Kuhl, Ann. Wetterau. Gesellsch. Naturk., IV (= Neue Ann., I), pt. 2, p. 202.

1821. *Vespertilio collaris* Schinz, Das Thierreich von Cuvier, I, p. 177 (Mt. Blanc, Haute-Savoie, France).

1834. *Vespertilio humeralis* Baillon, Mém. Soc. Royale d'Émulation d'Abbeville, 1833, p. 50 (Abbeville, Somme, France).

1837. *Vespertilio schinzii* Brehm, Ornis, Heft III, p. 27 (Renthendorf, Thüringen, Germany).

1843. *V[espertilio] schrankii* Wagner, Wiegmann's Archiv für Naturgesch., IX, Bd. II, p. 25 (Munich, Germany? See Fitzinger, Sitzungsber. kais, Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LXII, pt. 1, p. 219, 1871).

1857. *Vespertilio mystacinus* Blasius, Säugethiere Deutschlands, p. 96.

1863. [*Brachyotus mystacinus*] var. *nigricans* Koch, Jahrb. des Vereins für Naturkunde im Herzogthum Nassau, XVIII, p. 444 (Wiesbaden, Nassau, Germany).

1863. [*Brachyotus mystacinus*] var. *rufofuscus* Koch, Jahrb. des Vereins für Naturkunde im Herzogthum Nassau, XVIII, p. 444 (Wiesbaden, Nassau, Germany).

1863. [*Brachyotus mystacinus*] var. *aureus* Koch, Jahrb. des Vereins für Naturkunde im Herzogthum Nassau, XVIII, p. 445 (Breisgau, Germany).

1869. [*Vespertilio mystacinus*] var. *nigricans* Fatio, Faune Vert. Suisse, I, p. 92 (Switzerland). Not of Koch, 1863.

1869. [*Vespertilio*] *lugubris* Fatio, Faune Vert. Suisse, I, p. 93 (Alternative for *nigricans* Fatio).

1871. *Vespertilio mystacinus*, *nigro-fuscus* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LXII, pt. 1, p. 217 (Renaming of *V. schinzii* Brehm).

1878. *Vespertilio mystacinus* Dobson, Catal. Chiropt. Brit. Mus., p. 314.

1900. *Myotis mystacinus* Méhely, Monogr. Chiropt. Hungariæ, p. 200.

1910. *Myotis mystacinus* Trouessart, Faune Mamm. d'Europe, p. 33.

Geographical distribution.—Entire Continent of Europe north to about the limits of tree growth: west to Ireland; east into Asia.

Diagnosis.—Smallest species of European *Myotis* (forearm about 34 mm., longest finger about 60 mm., condylobasal length of skull 12·6 to 13·2 mm.); ear moderately long, extending 1 to 2 mm. beyond tip of muzzle when laid forward, its posterior border with shallow inconspicuous emargination: foot about half as long as tibia: wing membrane extending to base of outer toe; last caudal vertebra free.

External characters.—General form slender and delicate, the legs and tail rather long, the membranes thin and semi-transparent. Muzzle with rather noticeable glandular swellings. Ear extending slightly beyond nostril when laid forward, its general form rather slender, the tip narrowly rounded off, the posterior border with shallow inconspicuous concavity extending from just below tip to near middle of conch; inner surface of conch without well defined transverse striations. Antitragus small (length about 2 mm.) but well defined. Tragus a little more than half as high as conch, its width slightly above level of anterior base contained about $2\frac{1}{2}$ times in length of anterior border, the anterior border straight, the posterior border convex below; from widest region it narrows rather rapidly upward to a rather blunt point; posterior basal lobe well defined. Wing rather narrow, with no special peculiarity of form, the third, fourth and fifth metacarpals sub-equal, their distal extremities falling short of elbow by about 3 mm.: membrane inserted at base of outer toe. Foot about half as long as tibia; calcar slender, with barely indicated rudiment of keel and terminal lobe, its length slightly greater than that of free border of interfemoral membrane. Tail about as long as head and body, and twice as long as tibia, its terminal vertebra free from membrane.

Fur and colour.—The fur is soft and loose, the hairs on middle of back about 10 mm. in length, those of underparts a little more than half as long; it is closely confined to body, extending on wings to extreme base of membrane only, slightly farther below than above, and on interfemoral membrane over basal fifth or fourth of both surfaces; free border of uropatagium not fringed. Colour of upper parts a clear light brown resembling the wood-brown of Ridgway, but usually more yellow and always with a distinct metallic gloss, the basal portion of the hairs blackish-slate, this colour sometimes appearing at the surface and producing a general darkening effect: underparts paler and more buffy, usually not forming any decided contrast with back, but occasionally almost whitish, especially on chest; muzzle and cheeks dusky; ears and membrane blackish.

FIG. 29.
Myotis mystacinus.
Nat. size.

Skull.—The skull is slender and lightly built, the breadth of brain-case conspicuously greater than that of rostrum and slightly but appreciably less than half greatest length. Dorsal profile rising abruptly above low rostrum in interorbital region and forming a strong convexity over anterior portion of brain-case; occipital region distinctly produced backward and rising slightly but evidently above level of anterior portion of brain-case, from which it is marked off by a shallow but noticeable transverse constriction following anterior margin of inter-

parietal. Ventral profile rising slightly but evidently in region of floor of brain-case. Greatest depth of brain-case about three-quarters mastoid width; sagittal and lambdoid crests slightly indicated in fully adult individuals. Interorbital region obscurely short hour-glass shaped. Anteorbital foramen small, its posterior border over posterior root of large premolar. Posterior palatal region rather narrow, its width immediately behind molars about equal to its greatest length, the median spine broad and short; mesopterygoid fossa slightly wider than long, the hamulars turned inward. Auditory bulla moderate, its greatest diameter nearly equal to distance between inner margins of bullæ.

Teeth.—Upper incisors sub-equal, about half as high as canine, each pair in contact or nearly so at base but diverging at tips, the cingulum of inner tooth horizontal, that of outer tooth oblique; crown of outer incisor squarish in cross section, that of inner somewhat elongated in axis of tooth-row; near point of contact each shaft bears a secondary cusp, this usually though not always better developed in outer than in inner tooth; distance between canine and outer incisor about equal to diameter of incisor, that between pairs a little more than twice as great. Lower incisors slightly but evidently imbricated, forming a continuous, broadly V-shaped row between canines; crown of i_3 subterete, its area more than half that of canine and about equal to that of pm_1, its blunt main cusp, the highest in the incisor series, situated at outer side, the three smaller cusps (third obsolete) on inner margin; i_1 and i_2 sub-equal, slightly lower than i_3, their crowns compressed, longer than high, trifid, that of second wider posteriorly than anteriorly, and usually with a minute postero-internal cusp. Upper canine relatively large, slightly higher than main cusp of large premolar, its shaft somewhat triangular in cross section, with broad postero-internal concavity and anterior and postero-external groove; posterior cutting edge well developed; cingulum complete but not forming evident secondary cusps. Lower canine lower and less acutely pointed than upper, its tip about on level with highest cusps of molars; cingulum usually forming a slight secondary cusp anteriorly. First and second upper premolars

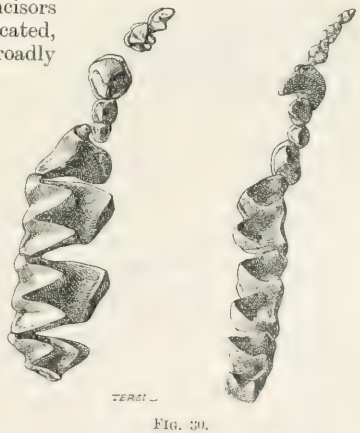

FIG. 30.

Myotis mystacinus. Teeth × 10.

alike in form, crowded between canine and large premolar but perfectly in the tooth-row, the first about the same size as the upper incisors, the second with slightly more than half the height and crown area of first, both with fully developed cingulum and subterete, conical cusp. Large upper premolar with crown area only a little less than that of first molar, the main cusp large and with strongly trenchant posterior cutting edge, its height about equal to that of largest molar cusps: anterior and posterior borders of crown slightly concave, inner border narrowly rounded, usually with a distinct though small cusp anteriorly, sometimes with another barely indicated posteriorly; a slight though evident concave crushing surface between cingulum and inner base of main cusp. First and second lower premolars essentially similar to the corresponding upper teeth but slightly less reduced in size and with somewhat higher cusps; third lower premolar similar to first and second but with rectangular crown nearly twice as large as that of second tooth, and main cusp as high as protoconid of first molar; a small cingulum cusp usually present at antero-internal angle. Upper molars rather large relatively to size of skull, the crown area of second tooth slightly greater than that of first; anterior and posterior borders slightly concave, inner border narrowly rounded, especially in m^2, the antero-internal and postero-internal outlines often flattened or even a little concave; protocone large, its base occupying entire inner border of tooth, its cusp a little in front of middle, its anterior commissure simple, extending uninterruptedly outward to parastyle, its posterior commissure terminating in a thickened rib like rudiment of a hypocone, between the outer base of which and inner base of metacone lies a deep furrow; metacone larger than paracone; styles and outer commissures well developed; third upper molar with crown area equal to about three-quarters that of m^1, the protocone as in the other teeth but smaller, paracone larger than metacone, the first outer commissure longer than in m^1 and m^2, the second and third about as in the other teeth but set at a different angle, the fourth, together with metastyle absent. First and second lower molars with second $\vee$ slightly larger than first in cross section, this condition reversed in m_3; protoconid decidedly higher than hypoconid in all three teeth; inner cusps of about equal height throughout (slightly more than half as high as protoconid); a distinct cingulum cusp behind entoconid.

Measurements.—Adult female from Skåne, Sweden: tibia, 15; foot, 7·6; **forearm**, 32; thumb, 6·2; third finger, 49; fifth finger, 38; ear from meatus, 12; width of ear, 8. Adult male from Madrano, Tyrol: head and body, 38; tail, 38; tibia, 16; foot, 8; **forearm**, 35; thumb, 6·2; third finger, 56; fifth finger, 47; ear from meatus, 13; width of ear, 9. Adult female from the Carpathian Mountains: head and body, 44; tail, 40; tibia, 15·4; foot, 8; **forearm**, 34; thumb, 7; third finger, 54; fifth finger,

45 ; ear from meatus, 14·2 ; width of ear, 9. **Forearm,** in other specimens : Waremme, Liége, Belgium, 33 and 33 ; Strass, near Burgheim, Bavaria, 31·6 ; Dresden, 33·2 ; Grotte de Vallorbe, Switzerland, 33 and 34·4. For cranial measurements see Table, p. 182.

Specimens examined.—Thirty-five, from the following localities :—

England : Newby Bridge, Lake Windermere, Cumberland, 1 ; Aberia, Merionethshire, 2 ; Colwyn, Denbighshire, 1 ; Cheadle, Staffordshire, 1 ; Manchester, Lancashire, 1 ; Ragley House, 1 ; Welford, Herefordshire, 2 ; Macclesfield, Cheshire, 1 ; Pewsey, Wiltshire, 1 ; Dover, Kent, 2 ; Hastings, Sussex, 1 ; Bath, Somerset, 1.

Sweden : Skullno, 1 ; Skåne, 1 (U.S.N.M.).

Belgium : Waremme, Liége, 2 (U.S.N.M.).

Germany : Moritzburg, Saxony, 1 (U.S.N.M.) ; Dresden, 1 ; Strass, near Burgheim, Bavaria, 1 ; Bavaria, no exact locality, 2 (U.S.N.M.).

Austria-Hungary : Haida, Arva, Bohemia, 1 ; Carpathian Mts., 1 (U.S.N.M.) ; Csallóköz-Somorja, Pressburg, 2 ; Tatra Mts., Hungary, 1.

Switzerland : Geneva, 1 (Mottaz) ; Grotte de Vallorbe, Vaud, 2 (Mottaz) ; Stein, Appenzell, 1 (U.S.N.M.) ; St. Gallen, 1 (U.S.N.M.) ; no exact locality, 1 (Geneva : type of *lugubris* Fatio).

Remarks.—*Myotis mystacinus*, the smallest European member of the genus, is recognizable by its small size and relatively short foot in combination with the insertion of wing membrane at base of outer toe. From the small species of *Pipistrellus* it is at once distinguished by the narrow muzzle and slender tragus.

2 ♀.	Aberia, Merionethshire, Wales.	G. H. Caton Haigh (C & P).	11. 1. 3. 13–14.
♀ st.	Colwyn, Denbighshire.	Hon. N. C. Rothschild (P).	6. 2. 4. 1.
1 al.	Newby Bridge, Cumberland, England.	T. Paul (C & P).	94. 9. 3. 1.
♀.	Cheadle, Staffordshire.	E. Blagg (C & P).	11. 1. 3. 15.
♂.	Manchester, Lancashire.	C. Oldham (P).	11. 1. 3. 10.
♂.	Ragley House, Warwickshire.	Tomes Collection.	7. 1. 1. 498.
2 ♀.	Welford, Herefordshire.	Tomes Collection.	7. 1. 1. 496–497.
♂.	Pewsey, Wiltshire. (*P. S. Hembly.*)	C. H. B. Grant (P).	11. 1. 3. 11.
♀.	Dover, Kent. (*B. Hesse.*)	C. H. B. Grant (P).	11. 1. 3. 12.
1.	Hastings, Sussex.	Miss I. Roods (C & P).	49. 1. 16. 1.
♂ st.	Bath, Somerset.	G. Dalgleish (C & P).	4. 10. 13. 3.
1.	Skullno, Sweden.	Stockholm Museum (E.)	46. 1. 2. 22.
♀.	Haida, Bohemia. (*Wolterstorff.*)	Lord Lilford (P).	11. 1. 1. 6.
1.	Csallóköz - Somorja, Pressburg, Hungary.	Budapest Museum (E).	94. 3. 1. 20–21.
1 al.	Tatra Mountains, Hungary.	Dr. R. Collett (P).	91. 1. 21. 1.

MYOTIS NATTERERI Kuhl.

1818. *Vespertilio nattereri* Kuhl, Ann. Wetterau. Gesellsch. Naturk., IV (= Neue Ann., I), pt. 1, p. 33.

1857. *Vespertilio nattereri* Blasius, Säugethiere Deutschlands, p. 88.

1863. [*Isotus nattereri*] var. *typus* Koch, Jahrb. des Vereins für Naturkunde im Herzogthum Nassau, XVIII, p. 430 (Wiesbaden, Nassau, Germany).

1863. [*Isotus nattereri*] var. *spelæus* Koch, Jahrb. des Vereins für Naturkunde im Herzogthum Nassau, XVIII, p. 430 (Erdbach, Nassau, Germany).

1878. *Vespertilio nattereri* Dobson, Catal. Chiropt. Brit. Mus., p. 88.

1900. *Myotis nattereri* Méhely, Monogr. Chiropt. Hungariæ, p. 179.

1904. *Myotis escalerai* Cabrera, Mem. Soc. Españ. Hist. Nat., II, p. 279 (Bellver, Lérida, Spain).

1910. *Myotis nattereri* and *M. escalerai* Trouessart, Faune Mamm. d'Europe, pp. 29–30.

Type locality.—Hanau, Hessen, Germany.

Geographical distribution.—Central and southern Europe, west to Ireland, north to southern Sweden.

Diagnosis.—Size medium among the European species (forearm about 38 mm., longest finger about 70 mm., condylobasal length of skull, 14·0 to 14·6 mm.); ear elongated, extending about 5 mm. beyond tip of muzzle when laid forward, the conch narrow (about 10 mm.), obscurely emarginate on upper half of posterior border, the tragus relatively longer than in any other European species, its height distinctly more than half that of conch; foot about half as long as tibia; wing membrane extending to base of outer toe; edge of interfemoral membrane fringed.

External characters.—General form essentially as in *Myotis mystacinus*, but differing in the following particulars: ear much longer and relatively narrower, extending conspicuously beyond nostril when laid forward, its extremity more broadly rounded off (owing to more uniform convexity of anterior border), and concavity on posterior border even less evident; antitragus about as large as in *M. mystacinus* but less well defined; tragus relatively longer and more attenuate than in any other European bat, its height conspicuously more than half that of conch, its greatest width contained about 3½ times in length of anterior border, its terminal third almost linear, sometimes faintly recurved, the basal lobe usually small and ill defined; insertion of wing membrane as in *M. mystacinus*, but membrane at first very narrow, so that in some specimens, particularly those that have been hardened in strong alcohol, the point of insertion appears to be on side of metatarsus;* tail rather shorter than head and body, only the cartilaginous extreme tip free; calcar better defined than in *M. mystacinus*, about as long as the distinctly fringed free border of interfemoral membrane.

* Such specimens seem to have formed the basis of the *Myotis escalerai* of Cabrera.

Fur and colour.—Quality and distribution of fur essentially as in *M. mystacinus*, but free border of interfemoral membrane distinctly though not very densely fringed with hairs about 1 mm. long. Colour of upper parts a lighter and less yellowish brown than in *M. mystacinus*, the exact shade intermediate between the wood-brown and broccoli-brown of Ridgway, the longer hairs with faintly darker tips visible in certain lights; underparts rather sharply contrasted whitish buffy grey; a well defined line of demarcation extending from shoulder to base of ear; basal portion of hairs clove-brown; muzzle and cheeks dusky, but not so dark as in *M. mystacinus*; ears and membranes dark brown.

Skull.—In all its dimensions the skull is appreciably larger than that of *Myotis mystacinus*. In general form it is slightly less slender. Forehead rising more abruptly but occipital region not higher than main portion of brain-case, so that dorsal profile shows a stronger concavity in interorbital region than that of *M. mystacinus*, while over greater extent of brain-case it is essentially flat, or slightly falling away posteriorly, instead of rising by two well defined curves to lambdal region. Posterior palatal region about as in *M. mystacinus*, except that mesopterygoid space extends further forward, and median spine is better developed. Auditory bulla relatively smaller than in *M. mystacinus*, its greatest diameter decidedly less than distance between bullæ.

Teeth.—In general the teeth resemble those of *Myotis mystacinus* apart from their greater size. They differ, however, in certain details of form: crown area of outer upper incisor appreciably greater than that of inner tooth; angle at front of lower incisor row wider, though evident; upper canine relatively weaker, its posterior cutting edge less developed, the cross section of its shaft half-terete owing to the obsolescence of postero-external and anterior longitudinal furrow; lower canine with length of base much greater in proportion to height of shaft, and cingulum more oblique; second upper premolar nearly equal to first in cross section; crown area of large premolar not so great relatively to that of first molar, the cusps on inner border obsolete or absent; lower premolars with less slender crowns, the cingulum of the third forming a very low, sometimes obsolete antero-internal cusp; molars, especially m^3, with narrower crowns.

Measurements.—External measurements of adult male from Colpin, Brandenburg, Germany, and adult male from Magdeburg, Germany: head and body, 50, 44; tail, 41, 40; tibia, 17, 16; foot, 8·2, 9·0; forearm, 39·2, 40·2; thumb, 7·0, 6·2; third finger, 71, 71; fifth finger, 56, 56; ear from meatus, 18, 18; tragus, 11·0, 11·2. Two adult females from Spain (No. 94. 1. 1. 8, Seville, and No. 8. 7. 23. 4 from Bellver, Lérida, paratype of *M. escalerai*): head and body, 46, 46; tail, 41, 43; tibia, 15, 17; foot, 7·6, 9·2;

forearm, 36·4, 40·6; thumb, 7·2, 8·4; third finger, 69, 72; fifth finger, 52, 56; ear from meatus, 16, 16·6; tragus, 10·2, 10±. For cranial measurements see Table, pp. 182–183.

Specimens examined.—Sixty-seven, from the following localities:—
SCOTLAND: Inverary, Argyllshire, 1.
ENGLAND: Harlech, Merionethshire, 3; Arrow Church, 6; Alcester, Warwickshire, 8; Lilford Hall, Northamptonshire, 5; Henley-on-Thames, Oxfordshire, 3 (B.M. and U.S.N.M.); Bradfield, Berkshire, 1; Queen Camel, Somersetshire, 1; Devonshire, 1; no exact locality, 3.
IRELAND: Co. Longford, 1; Woodpark, Co. Galway, 1.
GERMANY: Oberlausitz, Silesia, 1; Colpin, Brandenburg, 1; Magdeburg, Saxony, 2; Moritzburg, Saxony, 3 (U.S.N.M.).
AUSTRIA-HUNGARY: Haida, Arva, Bohemia, 1.
SWITZERLAND: Canton Thurgau, 3 (U.S.N.M.); St. Gallen, 9 (B.M. and U.S.N.M.).
ITALY: Arezzo, 4 (B.M. and U.S.N.M.); Valesia, 1 (U.S.N.M.); Siena, 1 (Mottaz); no exact locality, 4 (U.S.N.M.).
SPAIN: Bellver, Lérida, 2 (B.M. and Genoa; paratypes of *escalerai* Cabrera); Seville, 1.

Remarks.—This species is easily recognized by its rather small size, large ear, and very long, attenuate tragus. The exact point of insertion of wing membrane on side of foot is probably in all specimens the base of outer toe, but owing to a peculiar narrowing of the membrane along edge of metatarsal, the point of insertion sometimes appears to be at middle of side of foot. This effect is often increased by the action of strong alcohol.

♀.	Inverary, Argyllshire, Scotland.	Duke of Argyll (P).	58. 8. 16. 1.
1 al.	Longford, Ireland.	Dr. G. E. Dobson (C & P).	76. 11. 3. 2.
♀.	Woodpark, Galway.	R. F. Hibbert (P).	11. 1. 3. 20.
2 ♀, ♀ juv.	Harlech, Merionethshire, Wales.	J. Backhouse (P).	11. 1. 3. 16–18.
6.	Arrow Church, Warwickshire, England.	Tomes Collection.	7. 1. 1. 488–493.
8 al.	Alcester, Warwickshire.	Tomes Collection.	7. 1. 1. 736–743.
5 ♂ al.	Lilford Hall, Northamptonshire.	Lord Lilford (C & P).	72. 8. 21. 3–5. 72. 11. 12. 13.
♀.	Bradfield, Berkshire.	N. H. Joy (C & P).	11. 1. 3. 19.
♀ st.	Henley, Oxfordshire.	J. G. Millais (C & P).	1. 11. 2. 1.
♂ st.	Henley, Oxfordshire.	Heatley Noble (C & P).	0. 3. 23. 1.
♂ al.	Queen Camel, Somerset.	R. H. Read (P).	11. 1. 3. 21.
1 al.	England.	Dr. J. E. Gray (P).	51. 1. 29. 12.
♀.	Oberlausitz, Silesia, 340 m. Germany. (*W. Baer.*)	Lord Lilford (P).	99. 1. 9. 6.
♂ al.	Colpin, Brandenburg, Prussia.	Dr. H. Gadow (C & P).	82. 7. 31. 2.
♂ al.	Magdeburg, Saxony.	Dr. W. Wolterstorff (P).	92. 12. 1. 1.
♂.	Magdeburg, Saxony. (*Wolterstorff.*)	Lord Lilford (P).	11. 1. 1. 8–9.
♀.	Haida, Bohemia. (*Wolterstorff.*)	Lord Lilford (P).	11. 1. 1. 7.
3 ♂, ♀.	St. Gallen, 600 m. Switzerland. (*E. H. Zollikofer.*)	O. Thomas (P).	4. 4. 5. 4–8.

2 al.	Arezzo, Italy.	Florence Museum (E). 85. 7. 6. 4–5.
♀ al.	Bellver, Lérida, Spain.	A. Cabrera (P). 8. 7. 23. 4. (Paratype of *M. escalerai*, Cabr.)
1 al.	Seville.	Dr. V. L. Seoane 94. 1. 1. 8. (C & P).

MYOTIS EMARGINATUS Geoffroy.

1806. *Vesp[ertilio] emarginatus* Geoffroy, Ann. Mus. d'Hist. Nat., Paris, VIII, p. 198 (Charlemont, Givet, Ardennes, France).

1844. *Vesp[ertilio] rufescens* Crespon, Faune Méridionale, I, p. 20 (near Nîmes, Gard, France). Type in Nîmes Museum.

1853. *V[espertilio] ciliatus* Blasius, Wiegmann's Archiv für Naturgesch., 1853, I, p. 287 (near Cologne, Germany).

1856. *V[espertilio] schrankii* Kolenati, Allgem. deutsche Naturhist. Zeitung, Dresden, neue Folge, II, p. 178. A nomen nudum (ex Koch and Giebel) cited as synonym of *emarginatus*. Not of Wagner, 1843.

1858. *Vespertilio ciliatus* Blasius, Säugethiere Deutschlands, p. 91.

1878. *Vespertilio emarginatus* Dobson, Catal. Chiropt. Brit. Mus., p. 303.

1880. *Myotis ciliata* var. *budapestiensis* Margó, "Magyar orv. és természetvizsg. XX, nagygyűl. munk, p. 255" (Budapest, Austria-Hungary). See Méhely, Monogr. Chiropt. Hungariæ, p. 170.

1890. *Vespertilio neglectus* Fatio, Arch. Sci. Phys. et Nat., Genève, 3rd ser., XXIV, p. 512, November 15, 1890 (Valavran, near Geneva, Switzerland). Type in Geneva Museum.

1900. *Myotis emarginatus* Méhely, Monogr. Chiropt. Hungariæ, p. 170.

1910. *Myotis emarginatus* Trouessart, Faune Mamm. d'Europe, p. 28.

Type locality.—Charlemont, Givet, Ardennes, France.

Geographical distribution.—Central and southern Continental Europe.

Diagnosis.—Size essentially as in *Myotis nattereri* (forearm about 40 mm., condylobasal length of skull about 15 mm.); ear moderately long, extending 2 to 3 mm. beyond tip of muzzle when laid forward, its posterior border with a deep almost angular emargination slightly above middle; foot about half as long as tibia; wing membrane extending to base of outer toe; free margin of interfemoral membrane sometimes fringed; fur somewhat woolly in texture, the hairs of back tricolored, drab at base, yellowish at middle and dark brown at extreme tip.

External characters.—Whole animal larger and more robust than *Myotis mystacinus*, though of essentially the same form and proportions. Ears and membranes relatively thick and leathery, not semi-transparent as in the related small species. Ear moderately long, extending about 2 mm. beyond nostril when laid forward, its size and general form much as in *M. mystacinus* except that emargination of posterior border is deep and conspicuous, in most specimens forming an evident angle below. Inner surface of conch marked by seven or eight short but well developed cross ridges. Antitragus small and ill-defined. Tragus slightly more than half as high as conch, its greatest width contained nearly three times in length of anterior border, both its margins essentially straight from level of anterior base

to rather acute tip. Wing as in the related species ; metacarpals falling short of elbow by about 3 mm. ; membrane inserted at base of outer toe. Calcar slender, its termination usually marked by a distinct lobe, its length about equal to that of free border of interfemoral membrane. Tail relatively shorter than in *M. mystacinus*, extending to between ears when laid forward, only the minute cartilaginous tip free from membrane.

Fur and colour.—Fur shorter and more dense than in *M. mystacinus* and *M. nattereri*, and of a slightly woolly texture unique among the European species, the hairs at middle of back about 8 mm. in length. Distribution of fur not peculiar : free border of uropatagium sometimes with evident fringe. General colour buff, light and clear on underparts, dulled and irregularly clouded by darker brownish hair tips throughout upper parts ; basal half of hairs drab ; muzzle and cheeks dusky ; ears and membranes an indefinite rather light brown.

Skull.—In form the skull does not differ appreciably from that of *M. nattereri*, except that the rostral portion and palate are relatively more elongate and interorbital concavity is less strongly pronounced ; occipital region similarly low as compared with that of *M. mystacinus*. Mandible slightly more robust than in *M. nattereri*, but of similar form.

Teeth.—The teeth are larger than those of *Myotis mystacinus*, in this respect agreeing with those of *M. nattereri*. Upper incisors higher and more slender than in the preceding species, their crowns sub-equal in cross section ; lower incisors very slightly imbricated, forming a broadly and evenly convex (U-shaped) row without anterior angle, the crowns of i_3 and i_2 alike in form and distinctly 4-cusped, that of i_1 not thickened posteriorly and with no trace of postero-internal cusp. Canines about equal to those of *M. nattereri* in size, but shaft of upper tooth with evident postero-external longitudinal groove. First and second upper premolars even more strongly contrasted in size than those of *M. mystacinus*, the cusp of second only a little exceeding cingulum of first ; the two teeth less crowded between canine and large premolar than in *M. mystacinus* and *M. nattereri* ; lower premolars essentially as in *M. nattereri*, but less closely crowded, and second relatively larger. Upper molars as in *M. nattereri*, but crowns less narrowed ; a rudimentary commissure extending outward from base of hypocone and another extending inward from base of paracone ; lower molars not peculiar.

Measurements.—Two adult females from Florence, Italy : head and body, 46·6 and 50 ; tail, 40 and 42 ; tibia, 19 and 19 ; foot, 8·4 and 8·6 ; forearm, 40 and 41 ; thumb, 8 and 7·8 ; third finger, 67 and 70 ; fifth finger, 56 and 57 ; ear from meatus, 16·6 and 17 ; width of ear, 11·4 and 12. For cranial measurements see Table, p. 183.

Specimens examined.—Six, from the following localities :—
Holland : Maastricht, 1 (U.S.N.M.).

FRANCE: Near Nimes, Gard, 1 (Nimes: type of *rufescens* Crespon).
AUSTRIA-HUNGARY: Herkulesbad, 2.
SWITZERLAND: Valavran, near Geneva, 1 (Geneva: type of *neglectus* Fatio).
ITALY: Florence, 2 (U.S.N.M.); no exact locality, 1.

Remarks.—The peculiar form of the ear, the short, somewhat woolly fur, and the yellowish colour are highly characteristic of this well-defined species.

2 ♀.	Herkulesbad, Hungary.	Hon. N. C. Rothschild (P).	7. 9. 16. 9–10
skeleton without skull.	Italy. (Prince Bonaparte.)	Tomes Collection.	7. 1. 1. 733.

MYOTIS BECHSTEINII Kuhl.

1818. *Vespertilio bechsteinii* Kuhl, Ann. Wetterau. Gesellsch. Naturk., IV (= Neue Ann., I), pt. 1, p. 30 (Hanau, Hessen, Germany).
1857. *Vespertilio bechsteinii* Blasius, Säugethiere Deutschlands, p. 85.
1878. *Vespertilio bechsteinii* Dobson, Catal. Chiropt. Brit. Mus., p. 308.
1900. *Myotis bechsteinii* Méhely, Monogr. Chiropt. Hungariæ, p. 184.
1905. *Vesp[ertilio] bechst[einii] ghidinii* vel *Vesp[ertilio] ghidinii* Fatio, Arch. Sci. Phys. et Nat., Genève, 4th ser., XIX, p. 511, May 15, 1905 (Lugano, Ticino, Switzerland). Type in Geneva Museum.
1906. *Myotis bechsteinii favonicus* Thomas, Ann. and Mag. Nat. Hist., 7th ser., XVIII, p. 220, September, 1906 (La Granja, Segovia, Spain). Type in British Museum.
1910. *Myotis bechsteini* and *M. bechsteini favonicus* Trouessart, Faune Mamm. d'Europe, pp. 30–31.

Type locality.—Hanau, Hessen-Nassau, Germany.

Geographical distribution.—Central and southern Europe, west to England, north to southern Sweden.

Diagnosis.—Size slightly greater than that of *M. nattereri* (forearm about 40, condylobasal length of skull, 16 to 17); ear elongated, extending about 8 mm. beyond tip of muzzle when laid forward, the conch broad (about 15 mm.), its posterior margin obscurely emarginate above, the tragus scarcely half as high as conch; foot about half as long as tibia; wing membrane extending to base of outer toe.

External characters.—In general like *Myotis nattereri*, but with broader ears and relatively as well as actually larger legs and feet (combined length of tibia and foot about 30 mm. instead of less than 25). Muzzle with moderately developed glandular swellings (these less evident than in *M. mystacinus*). Ear extending considerably beyond nostril when laid forward, its length thus about as in *M. nattereri*, but its breadth so much greater (about 17 mm. instead of about 10 mm.) that the ear is relatively larger than in any other European bat except *Plecotus auritus*; form of ear essentially as in *M. mystacinus*, the upper half of posterior border faintly concave; inner surface of conch with about eight rather ill-defined transverse ridges near posterior border; antitragus about 2·5 mm. in length along base, rather abruptly

rounded off above, its inner margin not continuous with posterior border of conch. Tragus about half as high as conch, its form essentially as in *M. mystacinus* though a little more slender (greatest width contained nearly three times in height of anterior border); basal lobe small but well developed. Wing essentially as in *M. mystacinus;* third, fourth and fifth metacarpals sub-equal, falling short of elbow by about 5 mm.; membrane inserted at base of outer toe. Calcar and free border of interfemoral membrane as in *M. mystacinus*. Tail shorter than head and body (laid forward it extends to middle of crown), the terminal vertebra free.

Fur and colour.—Quality and distribution of fur as in *Myotis mystacinus* and *M. nattereri*. Upper parts uniform wood-brown with a slight tinge of umber, the exact shade almost impossible to describe exactly; underparts a buffy grey in strong contrast, irregularly clouded by the slaty brown of underfur; ears and membranes an indefinite dark brown.

Skull.—In general aspect the skull resembles that of *Myotis myotis*, due allowance being made for its much smaller size, since it is much more slender than in any of the other small species; breadth of brain-case equal to about one-half distance from lambda to posterior border of narial emargination. Dorsal profile rising gradually above rostrum and forming a strong convexity over anterior portion of brain-case, behind which it is essentially flat to lambda; ventral profile nearly flat, slightly elevated posteriorly; occipital region slightly projecting, just sufficiently to conceal condyles when viewed from above. Brain-case ovate, noticeably wider than rostrum; sagittal crest low but evident; lambdoid crest moderately developed at sides, obsolete at middle; greatest depth of brain-case about two-thirds mastoid breadth; floor of brain-case with obscurely defined lateral grooves. Interorbital region not evidently hour-glass shaped, owing to the slight widening at lachrymal level; anterior upper border of orbit slightly ridged. Rostrum slender, widening a little at anterior extremity, the dorsal surface smoothly rounded off at sides, though with indication of a slightly developed median groove; narial emargination narrow but deep, extending back about half way to level of anterior rim of orbit; rostral depth at front of orbit about equal to distance from orbit to middle of canine; palate long and narrow as compared with that of the other small species, both transverse and lateral concavities evident, especially just behind middle; anterior emargination rather large, sub-circular in general outline, extending back about to level of space between canine and first premolar; posterior extension of palate about as broad as long; interpterygoid space wider than long, encroached on by blunt median palatal spine. Mandible essentially as in *Myotis myotis*, the coronoid process higher and with more oblique posterior border than in the other small species.

Teeth.—The teeth are rather small relatively to size of skull.

Upper incisors essentially as in *M. mystacinus* but more slender. Lower incisors slightly imbricated, the row as a whole ∪-shaped or very broadly ∨-shaped, the form of the individual teeth not peculiar. Canines with no special peculiarities. Small upper premolars completely in tooth-row, not crowded, the crown area of first equal to about half that of canine, that of second to about two-thirds that of first, the height of first a little less than half that of canine, that of second about two-thirds that of first; cingulum complete but not forming secondary cusps. Large upper premolar with crown area nearly three-quarters that of first molar, its antero-internal cusp well developed. Lower premolars essentially as in *M. nattereri*. Upper molars with no special peculiarities except that m^3 is more reduced than in the other small species, its tranverse diameter through metacone noticeably less than half length of anterior border. Lower molars normal, but second triangle of m_3 a little more reduced than in the other small species, though much less so than in *M. myotis* and *M. oxygnathus*.

Measurements.—Adult female from Sweden: head and body, 46; tail, 38; tibia, 19·6; foot, 9·8; **forearm,** 42; thumb, 9·6; third finger, 67; fifth finger, 56; ear from meatus, 22; ear from crown, 19; width of ear, 13·6; tragus, 10. Two adults from the New Forest, Hampshire, England: tibia, 18·8 and 20; foot, 9·8 and 10·6; **forearm,** 39 and 42·4; thumb, 8·4 and 10; third finger, 64 and 68; fifth finger, 53 and 57. Adult male from Lugano, Switzerland (Geneva: type of *ghidinii* Fatio): tibia, 19·4; foot, 10; **forearm,** 41·2; thumb, 10·4; third finger, 65; fifth finger, 53; ear from meatus, 21±; ear from crown, 19; width of ear, 13; tragus, 11±. Adult female from Ste. Baume, Var, France: head and body, 53; tail, 37·4; tibia, 20; foot, 10·4; **forearm,** 42·6; thumb, 9; third finger, 70; fifth finger, 57; ear from meatus, 25·6; ear from crown, 24; width of ear, 16·2; tragus, 11·8. Adult male from Cadillac, Gironde, France: head and body, 45+; tail, 42; tibia, 20; foot, 9; **forearm,** 41; thumb, 8·8; third finger, 67; fifth finger, 56; ear from meatus, 26; width of ear, 15·6. Adult male from La Granja, Segovia, Spain (type of *favonicus* Thomas): head and body, 48; tail, 38; tibia, 20; foot, 8·4; **forearm,** 40; thumb, 8·2; third finger, 66; fifth finger, 55; ear from meatus, 23; ear from crown, 19; width of ear, 14·6; tragus, 10·4. Adult female from Zay-Ugrócz, Hungary: head and body, 46·6; tail, 44; tibia, 22; foot, 9; **forearm,** 44; thumb, 9; third finger, 73; fifth finger, 59; ear from meatus, 25; ear from crown, 22·6; width of ear, 16; tragus, 11·8. For cranial measurements see Table, p. 183.

Specimens examined.—Seventeen, from the following localities:—

ENGLAND: Henley-on-Thames, Oxfordshire, 1; New Forest, Hampshire, 6.

SWEDEN: Skåne, 1 (U.S.N.M.).

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case at middle.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
M. mystacinus.												
England: Aberia, Merionethshire .	11. 1. 3. 13	♀	12·8	–	3·2	4·2	6·4	4·2	—	5·0	—	Teeth not worn.
Manchester, Lancashire .	11. 1. 3. 10	♂	12·6	8·0	3·2	4·4	6·6	4·4	9·2	5·2	5·2	,, ,,
Macclesfield . . .	152537	♂	13·4	8·8	3·8	4·8	7·4	4·6	10·0	5·2.	5·6	,, slightly worn.
Dover, Kent . . .		♂	13·2	8·2	3·4	4·0	6·8	4·4	9·8	5·0	5·6	,, not worn.
,, ,, . . .	11. 1. 3. 12	♀	12·6	8·0	3·6	4·0	6·4	4·4	9·2	5·0	5·2	,, ,,
Sweden: Skane . . .	38352	♀	12·4	8·2	3·6	4·4	6·6	4·6	9·6	5·0	5·2	,, ,,
Austria-Hungary: Haida, Arva, Bohemia .	11. 1. 1. 7.	♀	13·0	7·8	3·4	4·2	6·8	4·2	9·6	5·2	5·4	,, ,,
Carpathian Mts.	122164	♀	13·6	9·0	3·8	4·6	7·2	4·6	10·0	5·2	5·4	,, ,,
Switzerland: no exact locality .	713. 21 (Geneva [3])		–	—	3·4	4·2	7±	–	9·6	5·2	5·1	,, ,,
Geneva . . .	1377 Mottaz	♂	13·0	8·0	3·4	4·4	6·8	—	10·0	5·2	5·6	,, ,,
Grotte de Vallorbe, Vaud . . .	2509 Mottaz	♀	13·0	7·8	3·4	4·4	6·8	4·6	9·6	5·2	5·6	,, ,,
Stein, Appenzel .	123626	♂	12·8	8·0	3·4	4·2	6·6	4·6	9·6	5·2	5·4	,, ,,
Italy: Madrano	37355	♂	13·4±	8·2	3·2	4·2	7·0	4·6	10·0	5·0	5·4	,, ,,
M. nattereri.												
England: Harlech, North Wales .	11. 1. 3. 18	♀	14·6	9·6	3·8	5·2	7·8	5·4	11·0	6·0	6·2	,, slightly worn.
Henley-on-Thames .	1. 11. 2. 1	♀	14·6	9·4	3·8	5·2	7·8	5·6	11·0	6·0	6·4	,, ,,
,, ,, .	152541	♂	14·4	9·8	4·0	5·0	8·0	6·0	11·2	5·8	6·2	,, not worn.
,, ,, .	152542	♂	14·4	10·0	4·0	5·0	8·0	5·8	11·4	5·8	6·2	,, moderately worn.
Germany: Magdeburg . .	152543	♂	14·8	—	4·0	5·2	8·0	5·8	11·2	6·0	6·6	,, slightly worn.
,, . . .	11. 1. 1. 9	♂	14·4	—	4·0	5·0	7·8	5·6	11·2	6·0	6·4	,, ,,

Austria-Hungary: Haida, Arva, Bohemia	11. 1. 1. 7	♀	—	9·8	3·6	5·2	7·6	5·8	11·4	5·8	6·2	Teeth moderately worn.
Switzerland: St. Gallen	4. 5. 4. 4	♂	14·4	9·4	3·8	5·2	7·8	5·6	11·2	6·0	6·4	,, not worn.
,,	4. 4. 5. 5	♂	14·2	9·4	3·8	4·8	7·8	5·8	11·0	5·8	6·2	,, ,,
,,	4. 4. 5. 6	♂	14·6	9·6	3·6	4·8	7·8	5·8	11·6	6·2	6·4	,, slightly worn.
,,	4. 4. 5. 7		14·0	9·4	3·6	4·6	7·6	5·4	11·0	6·0	6·2	,, not worn.
,,	4. 4. 5. 8	♀	14·4	9·6	3·8	5·0	7·6	5·8	11·4	6·0	6·2	,, slightly worn.
Thurgau	113866	♀	14·2	9·8	4·0	5·0	7·8	6·0	11·0	6·0	6·2	,, ,,
,,	113867	♀	14·2	9·6	3·8	5·2	7·6	5·6	10·8	5·8	6·2	,, ,,
,,	113868	♀	14·0	—	3·6	5·0	7·4	5·6	10·8	5·6	6·2	,, ,,
Italy: Valesia	38015	♀	14·6	9·4	3·6	5·0	7·8	5·6	11·0	5·8	6·4	,, not worn.
Arezzo	38354		—	9·4	3·8	5·0	8·0	5·6	11·0	5·8	6·2	,, moderately worn.
Spain: Bellver	8. 7. 23. 4†	♀	14·6	9·8	3·6	5·2	7·6	5·8	11·4	5·8	6·2	,, ,,
M. bechsteinii.												
England: New Forest, Hampshire	7. 7. 16. 1		—	—	4·0	5·0	—	—	12·2	6·8	7·2	,, not worn.
Henley-on-Thames	6. 9. 14. 1	♂	16·2	9·8	4·2	5·2	8·0	6·4	12·4	6·8	7·2	,, slightly worn.
Sweden:	38016	♀	16·0	10·0	4·2	5·0	8·0	6·0	12·6	7·0	7·2	,, not worn.
France: Étupes, Doubs	4067 Mottaz	♀	16±	10·2	4·2	5·4	8·0	5·6	12·4	6·8	7·6	,, ,,
Switzerland: Lugano, Ticino	712. 31 Geneva‡	♂	16·4	10·0	4·2	5·4	8·0	6·4	12·6	7·0	7·6	,, slightly worn.
Spain: La Granja, Segovia	6. 11. 4. 1§	♀	16·0	10·0	4·2	5·0	8·0	6·4	12·2	7·0	7·6	,, much worn.
Austria-Hungary: Zay-Ugrócz	6. 6. 20. 2	♀	16·8	10·6	4·4	5·4	8·2	6·2	13 0	7·0	7·4	,, moderately worn.
M. emarginatus.												
Austria-Hungary: Herkulesbad	7. 9. 16. 9	♀ (juv.)	—	—	—	—	—	—	11·2	6·4	6·8	,, not worn.
,,	7. 9. 16. 10	♀ (ad.)	14·8	9·6	3·6	5·2	7·2	5·4	11·6	6·2	6·8	,, slightly worn.
Holland: Maastricht	85517		—	—	3·8	5·2	—	5·8	11·4	6·2	6·8	,, much worn.
Italy: Florence	105295	♀	15·2	10·0	3·8	5·2	7·6	6·0	12·0	6·4	7·0	,, ,,
,,	105296	♀	15·0	9·8	3·6	5·0	7·4	5·6	12·0	6·4	6·8	,, slightly worn.

* Type of *lugubris* Fatio. † Paratype of *escalerai* Cabrera. ‡ Type of *ghidinii* Fatio. § Type of *favonicus* Thomas.

FRANCE: Étupes, Doubs, 1 (Mottaz); Ste. Baume, Var, 1 (Genoa); Cadillac, Gironde, 1 (Lataste).
SWITZERLAND: Lugano, Ticino, 1 (Geneva: type of *ghidinii* Fatio).
SPAIN: La Granja, Segovia, 1 (type of *faronicus* Thomas).
AUSTRIA-HUNGARY: Zay-Ugrócz, Trencsén, 4 (B.M. and U.S.N.M.).

Remarks.—This animal is recognizable among European bats by its medium size and very large ears. On the basis of the material examined I am unable to distinguish a Spanish or western geographical race.

♂.	Henley-on-Thames, Oxfordshire, England.	J. G. Millais (P).	6. 9. 14. 1.
1.	New Forest, Hampshire.	Dr. W. E. Leach (P).	56. A.
2.	New Forest, Hampshire.	G. W. H. Blagg (C & P).	7. 7. 16. 1–2.
♂ al.	La Granja, Segovia, Spain.	M. de la Escalera (C). (Type of *M. faronicus* Thos.)	6. 11. 4. 1.
♂, ♀ al.	Zay-Ugrócz, Trencsén, Hungary.	Budapest Museum (E).	6. 6. 20. 1–2.
1.	Europe.	Leyden Museum.	37. 4. 28. 23.

MYOTIS DAUBENTONII Kuhl.

1819. *Vespertilio daubentonii* Kuhl, Ann. Wetterau. Gesellsch. Naturk., IV (= Neue Ann., I), pt. 2, p. 195 (Hanau, Hessen, Germany).
1839. *Vespertilio ædilis* Jenyns, Ann. Nat. Hist., III, p. 73, April, 1839 (Aukland St. Andrew, Durham, England).
1844. *Vespertilio lanatus* Crespon, Faune Méridionale, I, p. 15 (South of Nîmes, Gard, France). Type in Nîmes Museum.
1857. *Vespertilio daubentonii* Blasius, Säugethiere Deutschlands, p. 98.
1871. *Vespertilio capucinellus* "Koch, Bayr. Fauna," Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LXII, pt. 1, p. 206 (Bavaria?).
1871. *Vespertilio minutellus* "Koch, Bayr. Fauna," Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LXII, pt. 1, p. 206 (Bavaria?).
1871. *Vespertilio daubentonii, albus* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LXII, pt. 1, p. 210 (Renaming of *V. ædilis* Jenyns).
1878. *Vespertilio daubentonii* Dobson, Catal. Chiropt. Brit. Mus., p. 297.
1890. *Vespertilio staufferi* Fatio, Faune Vert. Suisse, V, 3me suppl. aux Mamm., p. 6 (Lucerne, Switzerland). MS. synonym; repudiated.
1900. *Myotis daubentonii* Méhely, Monogr. Chiropt. Hungariæ, p. 164.
1910. *Myotis daubentoni* Trouessart, Faune Mamm. d'Europe, p. 27.

Type locality.—Hanau, Hessen-Nassau, Germany.

Geographical distribution.—Europe from the Mediterranean north to central Norway, west to Ireland, east into Asia.

Diagnosis.—Size nearly as small as in *Myotis mystacinus* (forearm about 35 mm., longest finger about 60 mm., condylobasal length of skull, 13·4 to 13·8); ear moderately long, extending about 2 mm. beyond tip of muzzle when laid forward, its posterior border with shallow inconspicuous emargination; foot decidedly more than half as long as tibia; wing membrane extending to side of metatarsus; last caudal vertebra free.

External characters.—Smallest of the large-footed European species. General form less slender and delicate than in *M. mystacinus*, the tail and legs relatively shorter. Ear rather short, extending, when laid forward, about to tip of muzzle; anterior border faintly and evenly convex from basal lobe to narrowly rounded-off tip; posterior border with shallow though evident concavity above; antitragus small and ill-defined; tragus about half as high as conch, its greatest width contained three times in length of anterior border, the posterior border moderately and evenly convex, the anterior border nearly straight, the tip rather blunt; posterior basal lobe relatively large and well defined. Wing slightly broader than in *M. mystacinus*, the three main metacarpals evidently graduated from third to fifth, the third very slightly shorter than forearm; membrane inserted at middle of metatarsus. Foot large, appreciably more than half as long as tibia; calcar slender, very long, without keel on posterior border and with slight terminal lobe, its length fully double that of free border of interfemoral membrane. Tail about as long as body without head, the terminal vertebra free from membrane except for an exceedingly narrow strip extending outward along each side.

Fur and colour.—Fur slightly shorter and more dense than that of *M. mystacinus*, but with no peculiarities of distribution except that it tends to spread farther outward along dorsal surface of interfemoral membrane; free border of uropatagium not fringed, but a slight fringe is usually present along basal half of calcar. Colour above essentially as in *M. nattereri*, though usually inclining more definitely toward wood-brown; underparts buffy grey usually less contrasted than in *M. nattereri*, though sometimes pale enough to produce a distinct line of demarcation along sides of neck. Muzzle and cheeks dusky. Membranes and ears an indefinite brown.

Skull.—The skull of *Myotis daubentonii* is smaller than that of any other European species except *M. mystacinus*. From this it is immediately distinguishable by its noticeably greater breadth both of rostrum, palate and brain-case, by the relatively lower occipital region, and relatively deeper rostrum. Posterior extension of palate short and broad, the width just behind molars greater than length to tip of hamular; median projection angular, seldom forming a distinct spine. Greatest breadth of brain-case slightly though appreciably more than greatest length of skull. Mandible with coronoid process low, scarcely rising above level of condyle.

Teeth. Teeth relatively smaller than those of *Myotis mystacinus*, a difference particularly noticeable in the crown areas of the first and second upper molars. Upper incisors as in *mystacinus*, but with cingulum less developed. Lower incisors very slightly imbricated, the form of the row vacillating between ⋃-shaped and broadly ⋁-shaped, the cusps as in *M. mystacinus* but less

developed. Canines both above and below weaker and less trenchant than in *M. mystacinus*, their form essentially as in *M. nattereri*. Premolars and lower molars not obviously different from those of *M. mystacinus*. Upper molars peculiar as compared with those of the small-footed European species in the presence of an evident protoconule on anterior commissure of protocone, the small cusp provided with a small but distinct secondary commissure extending to base of paracone; m^1 and m^2 with a small commissure extending from base of hypocone to base of metacone and partly filling depression lying between these cusps.

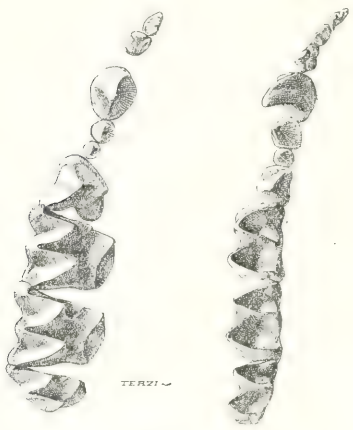

FIG. 31.
Myotis daubentonii. Teeth × 10.

Measurements. — Two adult males from Upsala, Sweden: head and body, 43 and 44; tail, 34 and 36; tibia, 17 and 17·4; foot, 11 and 11; **forearm**, 37 and 37; thumb, 8·4 and 8; third finger, 62 and 59; fifth finger, 49 and 49; ear from meatus, 13 and 13; width of ear, 10 and 9·6. Adult male and female from Lecco, Italy: head and body, 42 and 45; tail, 36 and 39; tibia, 16 and 17; foot, 10·6 and 11; **forearm**, 37 and 38; thumb, 8 and 8; third finger, 62 and 62; fifth finger, 51 and 51; ear from meatus, 13·6 and 13·6; width of ear, 9·6 and 9·4. For cranial measurements see Table, p. 190.

Specimens examined.—Seventy-three, from the following localities:—
SCOTLAND: No exact locality, 1.
ENGLAND: Bowdon, Cheshire, 1; Knutsford, Cheshire, 1; Stratford-on-Avon, Warwickshire, 2; Hillingdon, Middlesex 1,; Epping, Essex, 2; Northamptonshire, 1; Henley-on-Thames, Oxfordshire, 2 (B.M. and U.S.N.M.); Christchurch, Hampshire, 1; Devonshire, 1.
SWEDEN: Upsala, 3 (B.M. and U.S.N.M.); upland, 1; no exact locality, 2.
SWITZERLAND: Geneva, 1 (Mottaz).
FRANCE: Near Nîmes, Gard, 1 (Nîmes: type of *lanatus* Crespon).
ITALY: Lecco, Lombardy, 21 (U.S.N.M.); Pavia, 1 (U.S.N.M.); Florence, 30 (Mottaz).

Remarks.—This species is immediately recognizable among the European members of the genus by its small size, large foot, and naked upper surface of legs.

1.	Scotland.	Dr. J. Macgillivray (P).
♂.	Bowdon, Cheshire, England.	T. A. Coward (C & P). 11. 1. 3. 60.

♀.	Knutsford, Cheshire.	T. A. Coward (C & P).	11. 1. 3. 22.
2.	Stratford-on-Avon, Warwickshire.	Tomes Collection.	7.1.1. 486-487.
♂ al.	Hillingdon, Middlesex.	O. Thomas (C & P).	84. 1. 29. 1.
2 al.	Epping, Essex.	H. Doubleday (C & P).	44. 10. 21. 1–2.
al.	Northampton.	Mrs. Jenyns (P).	
♀ st.	Henley, Oxfordshire.	J. G. Millais (C & P).	1. 11. 2. 2.
1 al.	Christchurch, Hampshire.	Lord Lilford (P).	87. 9. 1. 1.
♂.	Upland, Sweden. (*G. Kolthoff.*)	Lord Lilford (P).	11. 1. 1. 25.
2.	Sweden.	Stockholm Museum (E).	46. 6. 2. 15. 48. 6. 28. 3.

MYOTIS CAPACCINII Bonaparte.

1837. *Vespertilio capaccinii* Bonaparte, Iconogr. Faun. Ital., I, fasc. XX (Sicily). Type in British Museum.

1839. *Vespertilio megapodius* Temminck, Monogr. de Mamm., II, p. 189 (Sardinia).

1841. *Vesp[ertilio] dasypus* de Sélys-Longchamps, Atti della seconda Riunione degli Scienziati Italiani, Torino, 1840, p. 249 (Published as synonym of *capaccinii*).

1844. *Vesp[ertilio] pellucens* Crespon, Faune Méridionale, I, p. 16 (Cave near Pont-du-Gard, Gard, France).

1857. *Vespertilio capaccinii* Blasius, Säugethiere Deutschlands, p. 101.

1877. *Vespertilio blasii* Major, Atti Soc. Tosc. Sci. Nat., Pisa, III, p. 108 (New name for the *capaccinii* of Blasius should it prove to be different from that of Bonaparte).

1878. *Vespertilio majori* Ninni, Atti Reale Instit. Veneto, 5th ser., IV, pt. 1, p. 721 (Substitute for *blasii* Major).

1878. *Vespertilio capaccinii* Dobson, Catal. Chiropt. Brit. Mus., p. 293.

1901. *Myotis capaccinii* Thomas, Proc. Zool. Soc. London, p. 37.

1910. *Myotis* (*Leuconoë*) *capaccinii* Trouessart, Faune Mamm. d'Europe, p. 26.

Type locality.—Sicily.

Geographical distribution.—Mediterranean region, north to Italian Switzerland, east into Asia.

Diagnosis.—Not so small as *Myotis daubentonii* (forearm about 42 mm., longest finger about 68 mm., condylobasal length of skull, 14·0 to 14·8 mm.), but similar in form and proportions; wing membrane extending to ankle; last caudal vertebra free; tibia and adjacent membrane densely furred.

External characters.—In all essential features the external form is as in *M. daubentonii*. The foot, however, is relatively larger, and the wing membrane is inserted at the ankle.

Fur and colour. Fur rather dense and short, the hairs at middle of back about 6 mm. in length; distribution peculiar among the European members of the genus in its tendency to spread on membranes, forming a distinct patch on upper surface of wing at elbow and extending over entire uropatagium to level of feet, the furry covering of tibia and immediately adjacent membrane (both above and below) especially dense. Colour

above a light drab tinged with grey or with ecru-drab, the general effect paler and more greyish than in any of the other European species; underparts pale buffy grey, rather strongly contrasted and with moderately well-defined line of demarcation along sides of neck. Underfur slaty black. Muzzle and cheeks faintly dusky. Ears and membranes an indefinite rather light brown.

Skull.—In all respects the skull so closely resembles that of *Myotis daubentonii* that it is only distinguishable by its larger size. From the skulls of *M. nattereri* and *M. emarginatus* it differs in its greater breadth, a character perhaps most readily appreciable in the form of the post-palatal region.

Teeth. Except for their larger size the teeth resemble those of *Myotis daubentonii*. The crown area of upper molars is relatively less than in *M. nattereri* and *M. emarginatus*, though m^3 retains the broader outline characteristic of *M. daubentonii* and *M. mystacinus*. Upper molars with protoconule and its accessory small commissure, and m^1 and m^2 with commissure between hypocone and metacone as in *M. daubentonii*.

Measurements.—Average and extremes of **forearms** in four males and eight females from Lugano, Ticino, Switzerland: males, 39·9 (38·8–41); females, 39·4 (38·8–40·4). Sicily (type): tibia, 15·6; foot, 12; **forearm**, 39·2; thumb, 10; third finger, 56·2; fifth finger, 50. Adult male from Corleone, Sicily: head and body, 49; tail, 38; tibia, 16; foot, 10; **forearm**, 41; thumb, 8·2; third finger, 68; fifth finger, 55; ear from meatus, 15; width of ear, 10·4. Two adult males from Sassari, Sardinia: head and body, 50 and 51; tail, 37 and 37; tibia, 16·4 and 17; foot, 10·6 and 11; **forearm**, 39·4 and 41·6; thumb, 8·4 and 8·6; third finger, 66 and 69; fifth finger, 51 and 56; ear from meatus, — and 14·4; width of ear, 10 and 10. For cranial measurements see Table, p. 191.

Specimens examined.—Seventy-two, from the following localities:—

Austria-Hungary: Herkulesbad, 1.

Switzerland: Near Lugano, 49 (B.M., U.S.N.M., and Mottaz).

Italy: Finalborgo, Liguria, 2 (Genoa); Pavia, 1 (U.S.M.M.); Ostia, Rome, 2; Marsala, Sicily, 1; Corleone, Sicily, 1 (U.S.N.M.); Sicily, no exact locality, 1 (type).

Sardinia: Cagliari, 4 (B.M. and U.S.N.M.); Sassari, 5 (U.S.N.M.); Grotte de Sardale, 2.

France: Marseilles, 1 (U.S.N.M.).

Spain: Inca, Majorca, Balearic Islands, 1; Elche, Alicante, 1.

Remarks.—In general appearance this species resembles *Myotis daubentonii*; but it is immediately recognizable by its even larger foot, and by the densely pubescent upper surface of leg, the latter character unique among European bats.

4 ♂, ♀.	Near Lugano, Ticino, Switzerland. (*E. H. Zollikofer.*)	O. Thomas (P).	2. 8. 4. 10–14.
2.	Ostia, Rome.	Dr. L. Sambon (C & P).	1. 1. 2. 3–4.

skeleton without skull.	Italy. (Prince Bonaparte.)	Tomes Collection. (*Type* of species.)	7. 1. 1. 734.
♀.	Marsala, Sicily. (*A. Robert.*)	O. Thomas (P).	6. 8. 4. 21.
2 al.	Cagliari, Sardinia.	Florence Museum (E).	85. 7. 6. 6–7.
2 al.	Grotte de Sardale, Sardinia.	O. Thomas (P).	0. 12. 3. 1–2.
♂.	Inca, Majorca, Balearic Islands.	O. Thomas and R. I. Pocock (C & P).	0. 7. 1. 3.
♂.	Elche, Alicante, Spain.	G. S. Miller (C).	8. 8. 4. 13.

MYOTIS DASYCNEME Boie.

1823. *Vespertilio mystacinus* Boie, Isis, p. 965. Not *V. mystacinus* Kuhl (Jutland, Denmark).
1825. *Vespertilio dasycneme* Boie, Isis, p. 1200 (Renaming of *mystacinus* Boie).
1839. *Vespertilio limnophilus* Temminck, Monogr. de Mamm., II, p. 176 (Holland).
1857. *Vespertilio dasycneme* Blasius, Säugethiere Deutschlands, p. 103.
1878. *Vespertilio dasycneme* Dobson, Catal. Chiropt. Brit. Mus., p. 295.
1904. *Myotis dasycneme* Trouessart, Catal. Mamm. Tam viv. quam foss., suppl., p. 88.
1910. *Myotis dasycneme* Trouessart, Faune Mamm. d'Europe, p. 27.

Type locality.—Chalk quarries at Dagbierg, near Wiborg, Jutland, Denmark.

Geographical distribution.—Central and southern Europe, west to the Atlantic coast,* north to Sweden, east into Asia.

Diagnosis.—Form and proportions essentially as in *Myotis daubentonii* and *M. capaccinii*, but size much larger (forearm about 47 mm., longest finger about 75 mm., condylobasal length of skull about 16 mm.); tibia and adjacent membrane naked.

External characters.—Form not essentially different from the other European members of the large-footed group. Tragus relatively shorter than in any other European *Myotis*, its height distinctly less than half that of conch, its anterior border slightly concave, its posterior border slightly convex below, then more abruptly convex to bluntly rounded off tip, the two margins essentially parallel through lower half. Free border of uropatagium without fringe.

Fur and colour.—Distribution of fur as in *Myotis daubentonii*; quality not peculiar, the longest hairs on middle of back about 8 mm. in length. Colour of upper parts a light yellowish wood-brown; underparts strongly contrasted greyish white with a tinge of buff, the line of demarcation along sides of neck well defined. Muzzle and cheeks scarcely contrasted dusky. Underfur slaty black. Ears and membranes an indefinite dark brown.

* The supposed British record is probably erroneous (see Barrett-Hamilton, Hist. Brit. Mamm., I, pp. 157–158. December, 1910).

CRANIAL MEASUREMENTS OF *MYOTIS DAUBENTONII*, *M. CAPACCINII* AND *M. DASYCNEME*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case at middle.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
M. daubentonii.												
England: Hillingdon, Middlesex.	84. 1. 29. 1	♂	13·8	9·0	4·0	5·0	7·8	5·4	10·2	5·2	5·6	Teeth slightly worn.
Bowdon, Cheshire .	11. 1. 1. 22	♀	13·6	9·0	4·0	5·0	7·8	5·2	10·0	5·2	5·6	,, ,,
Henley-on-Thames .	1. 11. 2. 2	♀	13·4	—	4·0	5·0	7·6	5·2	10·0	5·0	5 4	,, not worn.
,, ,, .	152538	♂	13·2	8·4	4·0	4·8	7·4	5·2	9·8	5·0	5·4	,, moderately worn.
Sweden: no exact locality . .	49. 11. 22. 16		13·6	—	3·8	5·0	7·6	5·6	10·0	5·2	5·4	,, not worn.
Upland . . .	11. 1. 1. 25	♂	13·8	9·0	4·0	5·2	7·8	5·4	10·2	5·2	5·6	,, ,,
Upsala . . .	85183	♂	13·6	—	4·0	5·0	8·0	5·2	10·0	5·2	5·4	,, ,,
Italy: Lecco, Lombardy . .	86562	♂	13·2	8·6	3·8	4·8	7·6	5·2	9·8	5·2	5·6	,, slightly worn.
,, ,, . .	82566	♂	13·4	8·2	4·0	5·0	7·8	5·2	10·2	5·2	5·6	,, not worn.
,, ,, . .	82570	♀	13·2	8·8	4·0	5·0	7·4	5·2	10·0	5·0	5·4	,, ,,
,, ,, . .	86563	♀	13·2	8·4	4·0	4·8	7·4	5·0	9·8	5·0	5·4	,, ,,
,, ,, . .	86572	♀	13·2	8·6	4·0	4·6	7·6	5·2	10·0	5·2	5·6	,, slightly worn.
,, ,, . .	86574	♀	13·2	8·4	3·8	4·6	7·6	5·0	10·0	5·2	5·6	,, ,,
,, ,, . .	86578	♀	13·4	9·0	4·0	5·0	7·8	5 2	10·0	5·0	5·4	,, ,,
Florence . . .	5423 Mottaz	♀	13·4	8·8	4·0	4·8	8·0	5·6	10·0	5·0	5·4	,, ,,
,, . . .	5429 Mottaz	♀	13·8	9·0	4·0	5·0	8·0	5·8	10·2	5·2	5·8	,, ,,
,, . . .	5433 Mottaz	♀	13·6	9·0	4·0	5·0	8·0	-	10·2	5·2	5·6	,, ,,
,, . . .	5437 Mottaz	♀	13·6	9·0	4·2	4·8	8·0	5·6	10·0	5·2	5·6	,, ,,

M. capaccinii.												
Switzerland: San Martino, Ticino	2. 8. 4. 10	♂	14·4	9·4	3·8	5·2	8·0	5·8	10·4	5·8	6·0	Teeth not worn.
,, ,,	2. 8. 4. 11	♂	14·6	9·4	3·6	5·4	8·2	5·8	11·2	6·0	6·2	,, ,,
,, ,,	2. 8. 4. 12	♂	14·8	9·4	3·8	5·4	8·2	5·8	11·2	5·8	6·2	,, ,,
,, ,,	2. 8. 4. 13	♂	14·8	9·6	3·8	5·4	8·0	5·8	11·0	5·8	6·2	,, ,,
Lugano ,,	121199	♂	14·4	9·4	3·8	5·4	8·0	5·8	11·0	5·8	6·2	,, slightly worn.
,, ,,	121192	♀	14·2	9·2	3·6	5·2	8·0	5·4	—	5·6	—	,, ,,
,, ,,	121193	♀	14·4	9·6	3·8	5·2	8·0	5·4	11·2	5·8	6·2	,, not worn.
,, ,,	121194	♀	14·2	9·2	3·8	5·0	8·0	5·6	11·0	5·6	6·0	,, ,,
,, ,,	121195	♀	14·6	9·2	3·8	5·0	8·0	5·4	11·0	5·6	6·2	,, slightly worn.
,, ,,	121196	♀	14·4	9·2	3·6	5·2	8·0	5·6	10·6	5·6	6·0	,, not worn.
,, ,,	121201	♀	14·4	9·0	3·6	5·0	8·0	5·8	10·8	5·6	6·0	,, ,,
Italy: Ostia, Rome . . .	1. 1. 2. 3		14·0	9·0	3·6	4·8	7·8	5·4	10·4	5·4	5·8	,, ,,
Sicily: Marsala	6. 8. 4. 21	♀	14·8	9·8	3·8	5·4	8·0	6·0	11·4	6·0	6·2	,, moderately worn.
Sardinia: Cagliari . . .	38348	♂	14·0	—	3·6	5·0	8·0	5·6	10·8	5·4	6·0	,, slightly worn.
,, . . .	38349	♂	14·2	9·6	3·6	5·0	8·0	5·6	11·0	5·6	6·0	,, moderately worn.
France: Marseilles . . .	38350	♂	14·6	9·0	3·6	5·0	8·0	5·6	11·0	5·8	6·0	,, not worn.
near Nimes, Gard . .	Hu. 180 Mottaz		14·6	9·8	3·8	5·2	8·0	5·8	11·0	5·8	6·0	,, slightly worn.
Balearic Islands: Inca, Majorca .	0. 7. 1. 3	♂	14·0	9·0	3·8	5·0	8·0	6·0	10·4	5·4	5·8	,, not worn.
Spain: Elche, Alicante . .	8. 8. 4. 13		14·6	9·6	3·8	5·2	8·0	5·8	11·0	6·0	6·2	,, moderately worn.
M. dasycneme.												
Holland: Leyden . . .	7. 1. 1. 501		16±	11·2	5·0	7·0	9·2	6·0	12·6	6·2	7·0	,, not worn.
Maastricht . . .	153985	♂	16·2	11·0	5·0	6·8	8·6	6·0	12·4	6·2	6·8	,, slightly worn.
,, . . .	153986	♂	16·0	11·2	5·0	6·8	9·0	5·8	12·2	6·0	6·8	,, ,,
,, . . .	153987	♀	16·0	10·8	5·0	6·6	8·6	6·0	12·0	6·2	6·6	,, not worn.
,, . . .	153988	♀	16·2	11·0	5·0	6·6	8·6	5·8	12·2	6·0	6·6	,, slightly worn.
Belgium: near Namur . .	9. 1. 11. 1	♂	16·8	11·2	5·0	6·8	9·0	5·8	12·8	6·4	7·0	,, not worn.

Skull.—The skull is large, slightly exceeding that of *Myotis bechsteinii* in length and noticeably surpassing it in breadth and robustness. Its general appearance is the least typically *Myotis*-like of any European member of the genus, a peculiarity heightened by the crowding of the small premolars and consequent shortening of anterior portion of tooth-row. Allowance being made for the great difference in size the skull is not very unlike that of *Myotis daubentonii*, but the rostrum is relatively shorter and the brain-case broader and more depressed. Sagittal crest barely indicated: auditory bullæ proportionately as in the smaller animal, less inflated than in *M. bechsteinii*; lachrymal ridge well developed, its lower extremity separated from lachrymal foramen by an evident notch.

Teeth.—In form the teeth resemble those of the small *Myotis daubentonii*; molars decidedly more robust than those of *M. bechsteinii*, the width of the crown diminishing much less rapidly toward inner border; small premolars much crowded, the second barely or not visible from outer side, the diameter of its crown, however, not much less than that of anterior tooth; upper molars as in *M. daubentonii* and *M. capaccinii*; mandibular teeth with no special peculiarities, the premolars and outer cusps of molars more slender than in *M. bechsteinii* and *M. daubentonii*.

Measurements.—Two adult males from Maastricht, Holland: head and body, 57 and 58; tail, 49 and 51; tibia, 19·8 and 20·2; foot, 11·8 and 12; **forearm,** 43·6 and 44; thumb, 9·6 and 9; third finger, 72 and 77; fifth finger, 57 and 62; ear from meatus, 17 and 17·2; width of ear, 10·6 and 11. Two adult females from the same locality: head and body, 60 and 61; tail, 47 and 46; tibia, 18 and 18; foot, 11·4 and 11; **forearm,** 44 and 44; thumb, 9 and 9; third finger, 76 and 75; fifth finger, 61 and 60; ear from meatus, 16·6 and 17; width of ear, 11 and 11. For cranial measurements see Table, p. 191.

Specimens examined.—Six, from the following localities:—
Holland: Leyden, 1; Maastricht, 4 (U.S.N.M.).
Belgium: Near Namur, 1.

1.	Leyden, Holland. (*H. Schlegel.*)	Tomes Collection.	7. 1. 1. 501.
♂ al.	Namur, Belgium.	Rev. D. B. Lebbe (C & P).	9. 1. 11. 1.

MYOTIS MYOTIS Borkhausen.

1775. *Vespertilio murinus* Schreber, Säugthiere, I, p. 165 (Not of Linnæus, 1758).

1797. *Vespertilio myotis* Borkhausen, Deutsche Fauna, I, p. 80 (Germany).

1797. *Vespertilio myosotis* B[orkhause]n, Der Zoologe (Compendiose Bibliothek gemeinnützigsten Kenntnisse für alle Stände, pt. XXI), Heft V, VIII, p. 46 (Germany).

1800. *Vespertilio myosotis* Bechstein, Pennant's Allgemeine Uebersicht der Vierfüssigen Thiere, p. 632 (Germany).

1801. *Vespertilio myotis* Bechstein, Gemeinn. Naturgesch. Deutschl., I, 2nd ed., p. 1154 (Described but not named in 1st ed., 1789, p. 164) Thüringen, Germany.

1827. *Vespertilio submurinus* Brehm, Ornis, Heft III, p. 24 (Renthendorf, Thüringen, Germany).

1844. *V[espertilio] latipinnis* Crespon, Faune Méridionale, I, p. 17 (Near Nîmes, Gard, France).

1857. *Vespertilio murinus* Blasius, Säugethiere Deutschlands, p. 82 (Not of Linnæus, 1758).

1863. [*Myotus murinus*] var. *typus* Koch, Jahrb. des Vereins für Naturkunde im Herzogthum Nassau, XVIII, p. 415 (Wiesbaden, Nassau, Germany).

1863. [*Myotus murinus*] var. *alpinus* Koch, Jahrb. des Vereins für Naturkunde im Herzogthum Nassau, XVIII, p. 415 (St. Gothard, Uri, Switzerland).

1878. *Vespertilio murinus* Dobson, Catal. Chiropt. Brit. Mus., p. 309 (Not of Linnæus, 1758).

1886. *Myotis murina* var. *spelæa* Bielz, Verhandl. u. Mittheilungen des Siebenbürgischen Vereins für Naturwissensch. in Hermannstadt, XXXVI, p. 83 (Homorod-Almas cave, Hungary).

1897. *Myotis myotis* Miller, Ann. and Mag. Nat. Hist., 6th ser., XX, p. 383, October, 1897.

1909. *Myotis myosotis* Miller, Ann. Mus. Zool. R. Univ. Napoli, N.S., III, No. 3, p. 1, April 26, 1909.

1910. *Myotis myotis* and *M. m. spelæa* Trouessart, Faune Mamm. d'Europe, p. 32.

Type locality.—Thüringen, Germany.

Geographical distribution.—Central and southern Continental Europe, west to Portugal, north to southern Sweden, eastward into Asia. One record of its occurrence in England.*

Diagnosis.—Largest species of European ***Myotis*** (forearm, 57 to 64 mm.; longest finger, 100 to 110 mm.; condylobasal length of skull, 22 to 23·6 mm.); form heavy, membranes thick and leathery; ear moderately long, extending about 5 mm. beyond tip of muzzle when laid forward, its posterior margin scarcely or not emarginate above middle; foot slightly more than half as long as tibia; wing membrane extending to base of outer toe.

External characters.—Although one of the largest European bats *Myotis myotis* does not differ conspicuously in form from the small *M. mystacinus*, except that its tail and legs are relatively shorter. The general build is not remarkably heavy as compared with other European species of approximately the same size, but the ears and membranes are rather thick and leathery. Ear moderately long, extending about 5 mm. beyond nostril when laid forward; anterior margin moderately convex from base nearly to rather narrowly rounded-off tip; posterior border with shallow ill-defined concavity above; antitragus low and long, marked off posteriorly by a well-defined notch and not continuous with posterior border of conch; tragus about half as high as

* Bell, Hist. British Quadrupeds, p. 38, 1836: "But in England it . . . has hitherto only been taken in the gardens of the British Museum."

conch, its greatest width (slightly above level of anterior base) contained about 2½ times in length of anterior margin, the posterior border convex to just below rather bluntly rounded tip, the anterior margin straight, posterior basal lobe small but well developed ; inner surface of conch with seven or eight ill-defined transverse ridges near posterior border. Wing rather broad but with no special peculiarities of form ; metacarpals somewhat elongated relatively to phalanges as compared with the smaller species, the third, fourth and fifth slightly but evidently graduated, the third scarcely shorter than forearm ; membrane inserted at side of metatarsus, but with a narrow strip extending to base of outer toe as in *M. nattereri*. Foot slightly more than half as long as tibia ; calcar heavy at base but tapering rapidly and terminating obscurely, its posterior border with slightly indicated keel, its length about equal to that of free border of interfemoral membrane. Tail about as long as body without head, only the extreme cartilaginous tip free from membrane.

Fur and colour.—Relatively to size of animal the fur is rather short (longest hairs of back about 10 mm.) ; in distribution it shows no peculiarities ; free border of uropatagium without fringe. Colour an indefinite brown much like that of *Myotis nattereri*, the exact shade intermediate between the wood-brown and broccoli-brown of Ridgway, usually paler on head and neck than on back, and in immature individuals than in adults, the hairs slate-black through basal half, then light wood-brown followed by a darker though not strongly contrasted terminal area. Underparts strongly contrasted greyish white with a slight buffy tinge ; a well-defined line of demarcation along sides of neck to ear, emphasized in region of shoulder by a slight, diffused blackening of edge of dark area. Muzzle and cheeks dusky. Ears and membranes an indefinite brown.

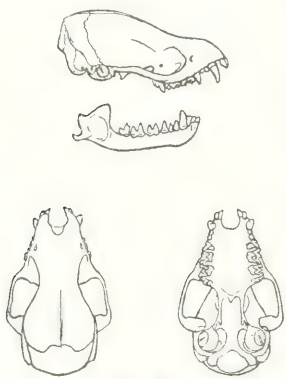

FIG. 32.
Myotis myotis. Nat. size.

Skull.—Though much larger than that of any of the other European species of *Myotis*, *M. oxygnathus* excepted, the skull of *Myotis myotis* is one of the most slender in general outline. The brain-case is longer proportionately to its breadth and is less contrasted with rostrum than in the small members of the group ; greatest breadth of brain-case about one-half distance from lambda to posterior margin of nares. Rostrum relatively deep and interorbital concavity relatively shallow ; occipital region

about on level with main portion of brain-case, and very slightly overhanging foramen magnum; ventral profile scarcely elevated posteriorly; palate rather narrow (essentially as in *M. mystacinus*); width of posterior extension of palate less than its length, median spine short but well developed; posterior border of anteorbital foramen over anterior root of first molar; mandible with coronoid process relatively higher and narrower than in the small species, its posterior border much more oblique.

Teeth.—The dentition is of a less primitive type than in the small European species of *Myotis*. This is indicated by the general tendency to reduction shown especially in the lower incisors, the small premolars and the posterior lower molar. Upper incisors rather high and slender but not essentially different in form from those of *M. mystacinus*, the cingulum of inner tooth obsolete, that of outer slightly developed. Lower incisors very strongly imbricated, the outline of the row U-shaped or broadly V-shaped; cutting edge of i_1 and i_2 trifid, but decidedly oblique owing to reduction in size of outer cusp; a minute cingulum cusp usually present at extreme outer edge; i_2 with small posterointernal tubercle; i_3 subterete, 4-tuberculate, the median outer tubercle largest. Canines relatively smaller than in *M. mystacinus* and with less developed posterior cutting edge, their form essentially as in *M. nattereri* and *M. emarginatus*. Small upper premolars much crowded, the second usually forced inward from line of tooth-row, sometimes so much so that the first is practically in contact with large premolar. In form they show no special peculiarities; shaft subterete; cingulum well developed. Large upper premolar more reduced than in the small species, the inner margin of crown a mere cingulum at base of main cusp, and without trace of secondary cusps. Lower premolars not peculiar in form, but middle tooth usually more crowded between first and third than in the small members of the group. Molars showing no special peculiarities of form; thickening that represents hypocone in m^1 and m^2 barely indicated; m^3 more reduced than in the small species, its metacone scarcely more than a slight widening of terminal portion of third commissure. First and second lower molars essentially as

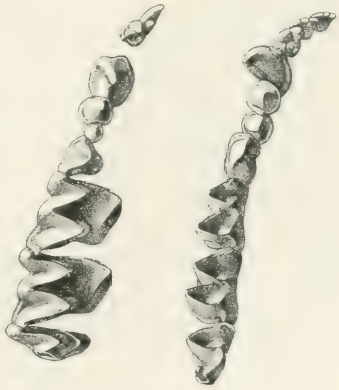

FIG. 33.
Myotis myotis. Teeth × 10.

CRANIAL MEASUREMENTS OF *MYOTIS MYOTIS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case at middle.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
France: Cadillac, Gironde	101326	♂	23·0	15·0	5·6	8·2	10·4	8·0	18·2	10·2	10·8	Teeth slightly worn.
Germany: Strass, near Burgheim, Bavaria	11. 1. 1. 13	♀	22·8	15·0	5·4	8·2	10·0	7·6	18·4	10·0	10·8	,, ,,
,, ,,	11. 1. 1. 14	♀	23·0	—	5·2	8·4	10·0	8·0	18·4	10·0	10·8	,, ,,
,, ,,	152545	♀	22·8	15·0	5·4	8·4	10·4	8·6	18·0	10·0	10·8	,, moderately worn.
,, ,,	11. 1. 1. 10	♀	23·0	—	5·2	8·4	10·0	7·4	18·4	10·0	11·0	,, slightly worn.
,, ,,	152544	♀	23·4	15·4	5·2	9·0	10·0	7·6	18·2	10·2	11·0	,, ,,
,, ,,	11. 1. 1. 15	♀	23·0	15·0	5·2	9·0	10·2	7·4	18·4	10·2	11·0	,, moderately worn.
Niesky, Silesia	97. 12. 4. 9	♀	22·6	15·0	5·2	8·0	10·6	8·2	18·0	10·0	11·0	,, slightly worn.
,, ,,	97. 12. 4. 10	♀	23·4	15·6	5·2	8·2	10·2	7·6	19·0	10·6	11·2	,, ,,
,, ,,	97. 12. 4. 12	♀	22·6	15·0	5·0	7·6	9·8	7·2	18·0	10·0	10·6	,, ,,
,, ,,	97. 12. 4. 13	♀	-	15·0	5·0	7·8	9·8	7.6	18·0	10·0	10·6	,, ,,
Roumania: Bustenari	4. 4. 6. 8	♂	22·4	15·2	5·2	7·6	10·4	7·8	18·0	10·0	10·6	,, ,,
,,	4. 4. 6. 9	♂		15·4	—	—	—	- -	18·4	10·4	11·0	,, ,,
,,	4. 4. 6. 10	♀	—	—	—	—	—	—	18·0	10·0	10·8	,, ,,
Switzerland: Geneva	322 Mottaz	♀	23·0	14·8	5·0	8·0	10·0	7·4	18·2	10·0	11·0	,, ,,
,,	323 Mottaz	♀	22·6	15·0	5·2	8·2	9·8	7·8	18·4	10·0	10·8	,, ,,
,,	324 Mottaz	♀	22·6	14·6	5·0	8·4	10·0	7·4	18·0	10·0	10·8	,, ,,
,,	325 Mottaz	♀	22·4	15·0	5·0	8·2	9·8	7·4	18·2	10·0	11·0	,, ,,

Switzerland: Geneva	326 Mottaz	♀	22·8	15·6	5·0	8·6	10·2	7·4	18·4	10·0	10·8	Teeth slightly worn.
,,	2273 Mottaz	♂	23·0	14·8	5·4	8·8	10·2	7·6	18·6	10·0	11·0	,, ,,
,,	2517 Mottaz	♂	23·0	15·0	5·2	8·4	10·0	7·4	18·6	10·0	11·0	,, ,,
Thayngen, Schaffhausen	145193	♂	22·6	14·8	5·2	8·2	10·4	7·2	18·0	10·0	10·8	,, not worn.
,, ,,	145194	♂	22·6	15·0	5·2	7·8	10·4	7·0	18·0	10·0	10·4	,, slightly worn.
Tägerwilen, Thurgau	113854	♀	23·6	15·4	5·2	8·8	10·4	7·4	18·8	10·2	11·0	,, moderately worn.
,, ,,	113855	♀	22·4	15·0	5·2	8·4	10·0	7·4	18·4	9·8	10·8	,, slightly worn.
,, ,,	113856	♀	22·8	15·0	5·2	8·4	10·4	7.4	17·8	10·0	11·0	,, ,,
,, ,,	113859	♀	23·2	15·0	5·2	8·0	10·2	7·6	18·8	10·2	11·2	,, moderately worn.
,, ,,	113861	♀	22·6	15·4	5·4	8·0	10·2	7·6	18·4	10·0	11·0	,, slightly worn.
,, ,,	113862	♀	22·0	14·8	5·4	7·6	10·0	7·4	17·8	10·0	10·6	,, not worn.
Andermatt, Uri	121191	♂	22·4	15·0	5·4	8·0	10·0	8·0	18·0	10·0	11·0	,, slightly worn.
Monte Generoso, Ticino	86648		23·0	15·2	5·0	7·6	10·2	8·0	18·6	9·8	10·6	,, ,,
,, ,,	86649	♀	22·6	15·0	5·0	7·6	10·0	7·4	18·4	10·2	11·0	,, moderately worn.
,, ,,	86647	♀	23·2	15·4	5·0	7·6	10·2	7·4	18·6	10·0	10·8	,, much worn.
Italy: Finalborgo, Liguria	Genoa	♀	22·4	15±	5·0	8·2	10·2	8·2	17·8	9·8	10·6	,, not worn.
Rome	11. 1. 2. 26	♀	22·0	15·0	5·0	8·0	10·0	7·4	17·8	9·8	10·4	,, moderately worn.
Florence	105301	♂	23·0	15·0	5·0	7·6	10·0	7·2	18·2	10·2	11·0	,, ,,
Sicily: Marsala	6. 8. 4. 17	♀	23·4	15·0	5·0	8·0	10·2	7·8	18·8	10·0	11·0	,, much worn.
,,	6. 8. 4. 18	♀	23·0	15·4	5·0	7·6	10·2	7·4	18·6	10·0	11·0	,, slightly worn.
,,	6. 8. 4. 19	♀	23·0	15·4	5·2	7·6	10·2	7·6	18·8	10·0	11·0	,, ,,
,,	6. 8. 4. 20		22·0	14·6	5·0	7·2	9·8	7·0	17·8	9·8	10·4	,, moderately worn.
,,	8. 9. 1. 3		22·6	—	5·0	8·2	10·2	8·0	18·0	10·0	10·6	,, ,,
,,	8. 9. 1. 4		23·4	15·8	5·4	8·0	10·2	8·2	19·0	10·0	11·0	,, much worn.
Sardinia: Cagliari	7. 5. 24. 9	♀	22·6	15·2	5·2	7·2	10·2	7·8	17·8	10·0	10·6	,, ,,
,,	7. 5. 24. 10	♀	22·4	15·0	5·0	7·4	10·0	8·2	17·8	10·0	10·6	,, moderately worn.

in the small species, except that cingulum does not form a postero-internal cusp behind entoconid; m_3 with hypoconid and entoconid more reduced than in the small species, the hypoconid displaced further inward, so that second triangle is barely half as large as first and conspicuously different from it in form.

Measurements.—Average and extremes of four adult females from Tägerwilen, Thurgau, Switzerland: head and body, 75·7 (72–79); tail, 56·3 (54–60); tibia, 26·1 (25·4–26·6); foot, 14·7 (13–16); **forearm**, 63 (63); thumb, 13·1 (12·8–13·4); third finger, 107·7 (106–109); fifth finger, 85·2 (84–86); ear from meatus, 27·6 (27–28); width of ear, 18·1 (17·6–19). Two adult females from Mte. Generoso, Ticino, Switzerland: head and body, 72 and 76; tail, 50 and 51; tibia, 25 and 25·4; foot, 15 and 14·4; **forearm**, 62 and 63·6; thumb, 13 and 12; third finger, 104 and 107; fifth finger, 83 and 84; ear from meatus, 27 and 28; width of ear, 18 and 18·6. Adult male from Florence, Italy: head and body, 68; tail, 55: tibia, 25; foot, 13; **forearm**, 61; thumb, 12; third finger, 100; fifth finger, 78; ear from meatus, 27·6; width of ear, 17·6. For cranial measurements see Table, p. 196.

Specimens examined.—Ninety-five, from the following localities:—

France: Cadillac, Gironde, 1 (U.S.N.M.); Nîmes, Gard, 2 (B.M. and Nimes; representing *latipinnis* Crespon, but not type).

Germany: Hamburg, 1; Niesky, Silesia, 11; Strass, near Burgheim, Bavaria, 8; Heidelberg, Baden, 1.

Austria-Hungary: Herkulesbad, 1; Fünfkirchen, S.W. Hungary, 2.

Roumania: Bustenari, 3; Sinaia, 1 (U.S.N.M.).

Switzerland: Geneva, 7 (Mottaz); Grotte de Vallorbe, Vaud, 1 (Mottaz); Boudry, Neuchatel, 2 (Mottaz); St. Moritz, 1; Thayngen, Schaffhausen, 2 (U.S.N.M.); Canton Thurgau, 5; Tägerwilen, Thurgau, 10 (U.S.N.M.); Andermatt, Uri, 1 (U.S.N.M.); St. Gothard, Uri, 3 (B.M. and U.S.N.M.); Monte Generoso, Ticino, 4 (U.S.N.M.).

Italy: Domodossola, 2 (U.S.N.M.); Finalborgo, Liguria, 1 (Genoa); Florence, 1 (U.S.N.M.); Rome, 2; Ostia, Rome, 2; Marsala, Sicily, 6.

Sardinia: Oristano, Cagliari, 10.

Spain: Seville, 2.

Portugal: Cintra, 2.

Remarks.—*Myotis myotis* differs strikingly from the other European members of the genus, *M. oxygnathus* excepted, in its much larger size. From the large *Vespertilionidæ* of other genera it is immediately recognizable by its long ears, extending noticeably beyond nostril when laid forward, and by the greyish white colour of the underparts. In the Mediterranean region *Myotis myotis* is associated with *M. oxygnathus*; but it is the only large species known to occur north of the Alps.

1 ad.	Nîmes, Gard, France.	G. E. Dobson (B).	80. 12. 14. 2.
1.	Hamburg, Germany.	Dr. J. E. Gray (P).	
2 ♂♂, 8 ♀♀, ♀ juv.	Niesky, Silesia. (*Dr. W. Baer.*)	Dr. E. Hamilton (P).	97. 12. 4. 7–17.
6 s.	Strass, Burgheim, Bavaria. (*Körbitz.*)	Lord Lilford (P).	11. 1. 1. 10–15.
s.	Strass, Burgheim, Bavaria. (*Körbitz.*)	Lord Lilford (P).	11. 1. 1. 124. 11. 1. 1. 131.

♀.	Heidelberg, Baden.	Hon. N. C. Rothschild (P).	10. 5. 29. 1.
♂ juv.	Herkulesbad, Hungary. (*F. J. Cox.*)	Hon. W. Rothschild (P).	7. 9. 16. 8.
2 al.	Füntkirchen.	Budapest Museum (E).	94. 7. 18. 11–12.
2 ♂, ♀.	Bustenari, Prahova, 840 m. Roumania. (*W. Dodson.*)	Lord Lilford (P).	4. 4. 6. 8–10.
1.	St. Moritz, Grisons, Switzerland.	Leon O. Galliard (P).	75. 9. 20. 4.
5 ♀.	Thurgau. (*E. H. Zollikofer.*)	O. Thomas (P).	4. 4. 5. 9–13.
2 ♀.	Rome. (*C. Coli.*)	G. Barrett-Hamilton (P).	11. 1. 2. 26–27.
2.	Ostia, Rome.	Dr. L. Sambon (C & P).	1. 1. 2. 1–2.
6 ♀.	Marsala, Sicily. (*A. Robert.*)	O. Thomas (P).	6. 8. 4. 17–20. 8. 9. 1. 3–4.
10 al.	Oristano, Cagliari, Sardinia.	Hon. N. C. Rothschild (P).	7. 5. 24. 1–10.
2 ♂ al.	Seville, Spain. (*Dr. A. Ruiz.*)	Lord Lilford (P).	73. 1. 8. 1–2.
2 ♂.	Cintra, Portugal.	O. Thomas (C & P).	98. 2. 2. 4–5.

MYOTIS OXYGNATHUS Monticelli.

1885. *Vespertilio oxygnathus* Monticelli, Ann. Accad. O. Costa de Aspir. Nat., I, p. 82. Type in Naples Museum.

1909. *Myotis oxygnathus* Miller, Ann. Mus. Zool. R. Univ. Napoli, N.S., III, No. 3, p. 1, April 26, 1909.

1910. *Myotis myotis oxygnathus* Trouessart, Faune Mamm. d'Europe, p. 32.

Type locality.—Matera, Basilicata, Italy.

Geographical distribution.—Mediterranean region from Spain to Greece, north to Italian Switzerland; Sardinia; Malta; Tunis.

Diagnosis.—Similar to *Myotis myotis* but smaller and with shorter, narrower ears: condylobasal length of skull, 18·6 to 21·4 instead of 22 to 23·6 mm.; mandible, 15·2 to 17·2 instead of 17·8 to 19 mm.; maxillary tooth-row, 8·2 to 9·4 instead of 9·8 to 10·6 mm.

Measurements.—Type (adult male): head and body, 63; tail, 54; tibia, 24·4; foot, 13; **forearm,** 57; thumb, 11·4; third finger, 98; fifth finger, 76; ear from meatus, 23; width of ear, 13·6; tragus, 10·8. Two adult males from Velletri, Rome, Italy: head and body, 60 and 62; tail, 58 and 58; tibia, 23 and 24·6; foot, 12·8 and 13; **forearm,** 53·6 and 57; thumb, 12 and 11; third finger, 89 and 86; fifth finger, 73 and 76; ear from meatus, 23 and 24; width of ear, 14 and 15. Two adult females from the same locality: head and body, 62 and 66; tail, 58 and 57; tibia, 24 and 24·6; foot, 13 and 12; **forearm,** 56 and 58; thumb, 11 and 11·8; third finger, 93 and 97; fifth finger, 74 and 78; ear from meatus, 23 and 22; width of ear, 13·6 and 13·6. Adult male and female from Bozen, Tirol: head and body, 68 and 71; tail, 53 and 53; tibia, 25·4 and 24; foot,

CRANIAL MEASUREMENTS OF *MYOTIS OXYGNATHUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case at middle.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
Spain: near Burgos . .	172127	♂	21·0	14·2	5·0	7·8	10·0	8·4	16·6	9·2	10·0	Teeth moderately worn.
,, . .	8. 8. 4. 10	♀	21·0	14·0	5·2	8·0	10·0	8·2	17·0	9·4	10·4	,, not worn.
Switzerland: Lugano, Ticino	86654		20·2	13·8	5·2	7·4	9·8	7·0	16·0	8·6	9·2	,, slightly worn.
Italy: Grotte de' Isoverde, Liguria . .	169 Genoa	♀	20·0	13±	4·8	7·4	9·4	7·0	16·0	8·2	9·2	,, ,,
Finalborgo . .	,,	♂	19·8	13·0	5·0	7·2	9·8	7·0	16·0	8·0	9·0	,, not worn.
,, . .	,,	♂	20·2	13·0	5·0	7·2	9·6	7·2	16·0	8·4	9·4	,, ,,
Vallombrosa, near Florence . .	114670	♂	20·2	13·6	5·2	7·2	9·6	7·4	16 2	9·0	9·6	,, moderately worn.
Rome . . .	11. 1. 2. 22	♂	20·2	14·0	5·2	7·6	9·8	7·0	16·2	8·8	9·2	,, slightly worn.
,, . . .	11. 1. 2. 23	♂	20·2	14·0	5·0	7·4	10·0	7·0	16·0	8·6	9·2	,, moderately worn.
,, . . .	11. 1. 2. 24	♂	20·2	13·8	5·0	7·6	10·0	7·0	16·0	8·8	9·4	,, not worn.
,, . . .	11. 1. 2. 25	♀	20·4	13·8	5·0	7·6	9·6	7·0	16·2	8·6	9·2	,, slightly worn.
Velletri, Rome. .	105771	♂	20·2	13·6	5·0	7·0	9·6	6·8	16·2	8·6	9·2	,, not worn.
,, . .	105772	♂	20·0	13·8	5·4	7·2	9·8	7·0	16·2	8·8	9·4	,, slightly worn.
,, . .	105773	♂	20·0	14·0	5·2	7·0	9·8	7·0	16·2	9·0	9·4	,, moderately worn.
,, . .	105775	♂	20·8	14·0	5·2	7·0	10·0	7·2	17·0	9·4	10·2	,, slightly worn.

Sardinia	37314	♂	21·2	14·2	5·0	7·0	10·0	7·4	17·2	9·4	10·4	Teeth not worn.
,, Gennargentu	86554	♂	21·0	14·6	5·0	7·0	10·0	7·6	17·0	9·4	10·4	,, slightly worn.
,,	86552	♀	20·4	—	5·0	7·0	9·8	7·6	16·6	9·2	10·0	,, ,,
,,	86553	♀	21·4	—	5·0	7·2	9·8	7·4	17·0	9·4	10·4	,, ,,
Cagliari	86511		20·6	—	5·0	7·0	9·8	7·2	16·6	9·2	10·0	,, ,,
Malta	11. 1. 1. 18	♂	—	13·4	5·0	7·4	9·2	—	16·2	8·8	9·8	,, ,,
,,	152250	♀	—	—	5·2	7·8	9·6	—	17·0	9·0	9·8	,, much worn.
,,	152249	♀	—	14·4	5·0	7·4	9·6	—	17·0	9·0	10·0	,, ,,
,,	11. 1. 1. 19	♀	—	14·0	5·0	7·8	9·8	—	17·0	9·2	10·0	,, ,,
Montenegro	5. 8. 4. 1	♂	20.2	14·0	5·0	7·0	9·8	7·0	16·4	8·8	9·8	,, slightly worn.
,,	5. 8. 4. 2	♂	20·8	13·8	5·0	7·2	9·6	6·8	16·6	9·0	9·8	,, moderately worn.
,,	5. 8. 4. 3	♀	20·2	13·8	5·0	7·0	10·0	7·6	16·2	9·0	9·6	,, ,,
Crete	5. 12. 2. 5	♂	21·0	14·8	5·0	8·0	10·0	7·0	17·2	9·2	10·4	,, ,,
,,	5. 12. 2. 6	♂	20·6	14·2	5·2	7·6	9·8	7·2	16·8	9·2	10·0	,, slightly worn.
,,	5. 12. 2. 7	♂	20·6	14·8	5·2	8·0	10·0	7·0	17·0	9·0	9·8	,, ,,
,,	5. 12. 2. 8	♀	20·8	14·0	5·0	7·2	9·8	7·0	16·6	9·0	10·0	,, not worn.
Greece: Corinth	145195	♂	19·0	13·2	5·0	6·6	9·2	6·8	15·6	8·2	9·0	,, slightly worn.
,,	145196	♂	20·0	13·6	5·2	6·8	9·2	6·8	16·2	8·6	9·6	,, ,,
,,	145199	♂	19·8	—	5·0	6·6	9·6	7·2	15·8	8·6	9·2	,, ,,
,,	145200	♂	18·6	12·4	5·0	6·4	9·0	6·6	15·2	8·0	9·0	,, ,,
,,	145201	♂	20·0	13·4	5·2	7·0	9·6	7·0	15·6	8·6	9·0	,, ,,
Tunis	122160	♂	21·0	14·2	5·2	7·2	9·8	7·4	17·0	9·2	10·0	,, moderately worn.

14 and 14; **forearm**, 59 and 60; thumb, 11·4 and 11·6; third finger, 97 and 98; fifth finger, 76 and 78; ear from meatus, 26 and 25; width of ear, 17 and 15. For cranial measurements see Table, p. 200.

Specimens examined.—Seventy-four, from the following localities:—
Spain: Near Burgos, 2.
Switzerland: Lugano, Ticino, 1 (U.S.N.M.).
Austria-Hungary: Bozen, Tirol, 3 (U.S.N.M.).
Italy: Finalborgo, Liguria, 2 (Genoa); Isoverde, 1 (Genoa): Vallombrosa, Florence, 1 (U.S.N.M.); Rome, 4; Velletri, Rome, 15 (U.S.N.M.); Matera, Basilicata, 1 (Naples, *type*).
Sardinia: Cagliari, 5 (U.S.N.M.); Monte Gennargentu, 3 (U.S.N.M.); no exact locality, 3 (U.S.N.M.).
Malta: El Ghain, 5; Rubato, 3; no exact locality, 4.
Montenegro: Beri, 4.
Greece: Patras, 2; Corinth, 7 (U.S.N.M.); Nauplia, 1 (U.S.N.M.); Lamia, Thessaly, 1 (U.S.N.M.)
Crete: Labyrinth, 4.
Tunis: No exact locality, 3 (U.S.N.M.).

Remarks. In general appearance ***Myotis oxygnathus*** resembles *M. myotis*, though the colour perhaps averages somewhat darker. It is readily distinguishable, however, by its smaller skull (distinctly smaller head in spirit specimens), and shorter, narrower ears. In form the skull is like that of *M. myotis*; and the teeth are not peculiar except for their small size, a character readily appreciable on comparison of the canines or of the crown area of upper molars. The range of *Myotis oxygnathus* is, so far as known, strictly Mediterranean, probably coincident with that of *M. capaccinii* and *Pipistrellus kuhlii*. North of the Alps *M. myotis* occurs alone.

♀.	Burgos, Spain.	G. S. Miller (c).	8. 8. 4. 10.
♂.	Rome, Italy. (*Coli.*)	G. Barrett-Hamilton (p).	11. 1. 2. 22–25.
♂ ♂ ♀ ♀.	El Ghain, Malta. (*Micallef.*)	Lord Lilford (p.)	11. 1. 1. 16–20.
♂ ♂ ♀.	Rubato, Malta. (*Micallef.*)	Lord Lilford (p).	11. 1. 1. 21–24.
4.	Malta. (*Micallef.*)	Lord Lilford (p).	95. 3. 2. 3–6.
♂ ♂ ♀ ♀.	Beri, 50 m. Montenegro. (*L. Führer.*)	O. Thomas (p).	5. 8. 4. 1–4.
♂ ♀.	Patras, Greece. (*C. Mottaz.*)	Hon. N. C. Rothschild (p).	8. 10. 2. 15–16.
♂ ♀.	Labyrinth, Crete.	Miss D. Bate (c).	5. 12. 2. 5–8.

Genus **PIPISTRELLUS** Kaup.

1829. *Pipistrellus* Kaup, Entw.-Gesch. u. Natürl. Syst. Europ. Thierwelt, I, p. 98 (*pipistrellus*).
1837. *Pipistrellus* Bonaparte, Iconogr. Faun. Ital., I, fasc. xx.
1838. *Romicia* Gray, Mag. Zool. and Bot., II, p. 495, February, 1838 (*calcarata* = *kuhlii*).
1839. *Vesperugo* Keyserling and Blasius, Wiegmann's Archiv für Naturgesch., 1839, I, p. 312 (part).
1856. *Hypsugo* Kolenati, Allgem. deutsche Naturhist. Zeitung, Dresden, neue Folge, II, p. 131 (*maurus* and *kraschenikowii*).

1856. *Nannugo* Kolenati, Allgem. deutsche Naturhist. Zeitung, Dresden, neue Folge, II, p. 131 (*nathusii*, *pipistrellus*, and *kuhlii*).

1857. *Vesperugo* Blasius, Säugethiere Deutschlands, p. 49 (part).

1878. *Vesperugo* Dobson, Catal. Chiropt. Brit. Mus., p. 183 (part).

1897. *Pipistrellus* Miller, Ann. and Mag. Nat. Hist., 6th ser., XX, p. 384, October, 1897.

1899. *Euvesperugo* Acloque, Faune de France, Mammifères, p. 35 (part, included *noctula*, *leisleri*, *maurus*, *kuhlii*, *pipistrellus*, and *abramus*).

1907. *Pipistrellus* Miller, Families and Genera of Bats, p. 204, June 29, 1907.

Type species.—*Vespertilio pipistrellus* Schreber.

Geographical distribution.—Entire mainland of Eastern Hemisphere to limits of tree growth, also Malay Archipelago, New Guinea, Solomon Islands, and northern Australia; in America from northern United States (except in boreal zone) to southern Mexico.

Characters.—Like *Eptesicus* (p. 224), but with 2—2 upper premolars; dental formula: $i\ \frac{2\ 2}{3\ 3}$, $c\ \frac{1\ 1}{1\ 1}$, $pm\ \frac{2\text{-}2}{2\text{-}2}$, $m\ \frac{3\ 3}{3\ 3} = 34$.

Remarks.—The genus *Pipistrellus* is widely distributed in the warmer portions of the Old World and of North America. About forty species are now known, four of which occur in Europe. Externally these may often be confused with the smaller *Myotis*, though they may usually be recognized by a certain heaviness of form, and more especially by the shorter ear and less slender tragus. Though often regarded as nearly related to *Nyctalus*, on account of the similarity of dental formula, this genus is much the more primitive of the two, its members showing no tendency to modify the ordinary vespertilionine wing structure. It is in reality not much more than a sub-genus of *Eptesicus* (see remarks under the latter), though for the sake of convenience the two groups are best treated as distinct.

KEY TO THE EUROPEAN SPECIES OF *PIPISTRELLUS*.

Anterior upper premolar excessively minute, sometimes hidden by the gum, its crown area much less than that of outer incisor; anterior lower premolar with crown area less than half that of posterior premolar; greatest width of tragus nearly equal to length of anterior border; hairs of back usually with noticeably contrasted light tips..... *P. savii*, p. 219.

Anterior upper premolar not excessively minute, never hidden by the gum, its crown area about equal to that of outer incisor; anterior lower premolar with crown area more than half that of posterior premolar; greatest width of tragus much less than length of anterior border; hairs of back without noticeably contrasted light tips.

Outer upper incisor less than half as high as inner; large upper premolar almost or quite in contact with canine, the small premolar forced inward from tooth-row and scarcely or not visible from outer side..... *P. kuhlii*, p. 215.

Outer upper incisor more than half as high as inner; large upper premolar separated from canine by distinct space in which the small premolar is clearly visible from outer side.

Lower canine robust, the length of base along cingulum about equal to length of anterior border of shaft; condylobasal length of skull 11 to 12 mm.; thumb short, its length about equal to width of wrist; fifth finger about 40 mm..... *P. pipistrellus*, p. 204.

Lower canine slender, the length of base along cingulum slightly more than half length of anterior border of shaft; condylobasal length of skull 12·6 to 13·4 mm.; thumb long, its length much greater than width of wrist; fifth finger about 46 mm..... *P. nathusii*, p. 213.

PIPISTRELLUS PIPISTRELLUS Schreber.

1774. *Vespertilio pipistrellus* Schreber, Säugthiere, I, pl. LIV. Described, I, p. 167, 1775, under name Die Zwergfledermaus. (France, based primarily on Daubenton.)

1776. *Vespertilio pipistrelle* P. L. S. Müller, Natursyst. Suppl. u. Regist.-Band, p. 16 (France, based on Schreber).

1825. *Vespertilio pygmæus* Leach, Zool. Journ., I, p. 560, January, 1825 (Dartmoor, Devonshire, England).

1834. *Vespertilio brachyotos* Baillon, Mém. Soc. Royale d'Émulation d'Abbeville, 1833, p. 50 (Abbeville, Somme, France).

1839. ? [*Vespertilio pipistrellus*] var. *nigra* de Sélys-Longchamps, Études de Micromamm., p. 140 (nomen nudum).

1839. ? [*Vespertilio pipistrellus*] var. *rufescens* de Sélys-Longchamps, Études de Micromamm., p. 140 (nomen nudum).

1840. *V[espertilio] pusillus* Schinz, Europ. Fauna, I, p. 9 (Synonym of *pipistrellus;* Brehm cited as authority).

1840. *V[espertilio] melanopterus* Schinz, Europ. Fauna, I, p. 9. Brehm cited as authority, but name apparently published here for first time (Rhentendorf, Thüringen, Germany).

1840. *V[espertilio] stenotus* Schinz, Europ. Fauna, I, p. 9. Brehm cited as authority, but name apparently published here for first time (Rhentendorf, Thüringen, Germany).

1840. *Vespertilio minutissimus* Schinz, Europ. Fauna, I, p. 9 (Zürich, Switzerland).

1845. *P[ipistrellus] nigricans* Bonaparte, Atti della sesta Riunione degli Scienziati Italiani, Milano, 1844, p. 340. Described but not named in Atti della seconda Riunione degli Scienziati Italiani, Torino, 1840, p. 247, 1841. (Sardinia.)

1845. *Pipistrellus genei* Bonaparte, Atti della sesta Riunione degli Scienziati Italiani, Milano, 1844, p. 340 (Alternative name for *nigricans*).

1845. *P[ipistrellus] typus* Bonaparte, Atti della sesta Riunione degli Scienziati Italiani, Milano, 1844, p. 340 (Substitute for *pipistrellus* Schreber).

1857. *Vesperugo pipistrellus* Blasius, Säugethiere Deutschlands, p. 61.

1862. *Vesperugo pipistrellus* var. *macropterus* Jeitteles, Verhandl. der k. k. Zool. Bot. Gesellsch., Wien, XII, p. 250 (Kaschau, Hungary).

1863. [*Nannugo pipistrellus*] var. *typus* Koch, Jahrb. des Vereins für Naturkunde im Herzogthum Nassau, XVIII, p. 490. Not of Bonaparte, 1845 (Wiesbaden, Hessen-Nassau, Germany).

1863. [*Nannugo pipistrellus*] var. *flavescens* Koch, Jahrb. des Vereins für Naturkunde im Herzogthum Nassau, XVIII, p. 491 (Nassau, Germany).

1863. [*Nannugo pipistrellus*] var. *nigricans* Koch, Jahrb. des Vereins für Naturkunde im Herzogthum Nassau, XVIII, p. 491. Not of Bonaparte, 1845 (Nassau, Germany).

1863. [*Nannugo pipistrellus*] var. *limbatus* Koch, Jahrb. des Vereins für Naturkunde im Herzogthum Nassau, XVIII, p. 491 (Siegen, Nassau, Germany).

1878. *Vesperugo pipistrellus* Dobson, Catal. Chiropt. Brit. Mus., p. 223.

1897. *Pipistrellus pipistrellus* Miller, Ann. and Mag. Nat. Hist., 6th ser., XX, p. 384, October, 1897.

1904. *Pipistrellus pipistrellus mediterraneus* Cabrera, Mem. Soc. Espan. Hist. Nat., II, p. 273 (Valencia, Spain).

1910. *Pipistrellus pipistrellus* and *P. pipistrellus mediterraneus* Trouessart, Faune Mamm. d'Europe, pp. 14–15.

Type locality.—France.

Geographical distribution.—Europe from the Mediterranean north to Scotland and Scandinavia, west to Ireland and the Hebrides, east into Asia.

Diagnosis.—Smallest European member of the genus (forearm, 27·6 to 32 mm.; condylobasal length of skull, 11 to 12 mm.); outer upper incisor more than half as high as inner incisor; large upper premolar separated from canine by a distinct space, the small tooth visible from outer side, its crown area about equal to that of outer incisor; anterior lower premolar with crown area equal to more than half that of succeeding tooth; lower canine robust, the length of base along cingulum about equal to length of anterior border of shaft; tragus with greatest width less than length of anterior border; thumb short, its length about equal to width of wrist; length of fifth finger about 40 mm.; posterior edge of wing membrane usually dark.

External characters.—General form robust, the tail and legs rather short, the membranes relatively thick and opaque. Muzzle with very noticeable glandular swellings extending back to beneath eye. Ear extending about to nostril when laid forward, its general form rather short and broad, though with narrowly rounded tip; anterior border abruptly convex at base, then essentially straight almost to tip; posterior border faintly and irregularly concave above, evenly convex below, the antitragal lobe represented by a thickened ridge extending along margin of ear and turning abruptly inward without producing any noticeable break in outline of conch. Inner surface of conch slightly rugose, but without evident cross ridges. Tragus erect, scarcely half as high as conch, its tip broadly rounded, its greatest width (slightly above level of anterior base) about half length of anterior border; except near tip, both borders are nearly straight or very slightly convex; posterior basal lobe small but well defined. Wing rather narrow, with no special peculiarities of form, the third, fourth and fifth metacarpals sub-equal (fifth slightly shorter than

the others) and extending nearly to point of elbow : fifth finger extending beyond elbow to a distance equal to less than one-third length of forearm ; thumb short, its length about equal to width of wrist ; membrane inserted at base of outer toe. Foot about half as long as the short, robust tibia ; calcar considerably longer than free border of interfemoral membrane, robust at base, but tapering rapidly and terminating without lobe, its keel well developed, with evenly convex margin. Tail about as long as body without head and $2\frac{1}{2}$ times as long as tibia, the short terminal vertebra free from membrane.

Fur and colour.—The fur is closely confined to the body, showing no tendency to spread on membranes. On wing it extends, both above and below, to line joining knee and basal third of humerus ; lower surface of interfemoral membrane essentially naked except at extreme base, upper surface furred nearly to middle. Colour of upper parts a uniform brown, in most specimens nearly intermediate between the wood-brown and cinnamon of Ridway but sometimes darker, with a strong tinge of prouts-brown or raw umber, this especially noticeable in immature specimens, though occasionally evident in adults ; under parts essentially like back though slightly less dark ; hairs everywhere slaty brown at base, those of upper parts with tips darker than sub-terminal band, but not enough so to produce a definitely tricolor effect. Ears and membranes blackish.

Skull.—Notwithstanding its small size, less than that of any other European bat, the skull is robust and heavily built as compared with that of the small species of *Myotis*. Dorsal profile rising gradually from nares to lambda, with slight concavity in interorbital region and slight convexity over middle of brain-case ; occipital region scarcely produced backward except for a median swelling between foramen magnum and lambda, on each side of which a condyle is just visible when skull is viewed from above ; ventral profile nearly flat except for a slight upward bend posteriorly. Brain-case ovate in general outline, its region of greatest breadth distinctly behind middle, its surface smooth or with faintly indicated sagittal crest and lateral portion of lambdoid crest ; greatest breadth of brain-case noticeably exceeding that of rostrum and slightly though evidently more than half greatest length of skull ; floor of brain-case flat, without vacuities ; a distinct groove between cochlea and median portion of floor, this groove bounded antero-externally by a slight though usually evident longitudinal ridge ; auditory bullæ moderately large, not peculiar in form ; interorbital region broadly hour-glass shaped, its least breadth about equal to breadth across roots of canines ; between constriction and anteorbital foramen the orbital margin is slightly but evidently

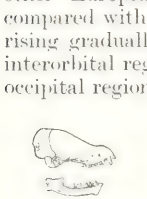

FIG. 34.
Pipistrellus pipistrellus. Nat. size.

inflated, the inflated region with a median angle suggesting a rudimentary postorbital process; rostrum short and broad, narrowing gradually in front, a slight concavity at each side bordering lachrymal inflation, and an evident median longitudinal groove, most noticeable posteriorly; nasal emargination slightly deeper than wide, extending less than half way to interorbital constriction; anteorbital foramen small, over point of contact between large premolar and first molar; palate broad, distinctly concave both longitudinally and laterally; anterior emargination small, wider than deep, its posterior border on line with posterior edge of canine; mesopterygoid fossa squarish, encroached on anteriorly by broadly triangular median palatal spine; hamulars slightly turned inward. Mandible robust, the ramus much deeper at symphysis than behind tooth-row, the coronoid process so low that upper edge of posterior portion of mandible is squarely and horizontally truncate, parallel with alveolar line; angular process short but well developed, on level with alveolar line, its extremity slightly bent inward.

Teeth.—Relatively to size of skull the teeth are rather large and robust, though inclined to be low, tendencies especially noticeable in the canines. Inner upper incisor robust, its shaft nearly half as high as that of canine, and directed strongly forward and slightly inward, its crown irregularly elliptical-oval in outline, with main axis nearly in line of tooth-row; secondary cusp large and conspicuous, about half as high as main shaft, from the postero-external surface of which it projects; cingulum well developed, often forming a minute postero-basal cusp. Outer upper incisor slightly but evidently smaller than inner, its shaft more than half as high as that of inner, to secondary cusp of which its extremity is closely approximated; crown outline essentially as in inner tooth but main axis lying at right angles to tooth-row; posterior surface of shaft broadly concave; inner margin with small though distinct secondary cusp; cingulum moderately well developed. The main cusps of the two teeth lie in line of general curve of anterior portion of tooth-row. Space between outer incisor and canine about equal to greatest diameter of incisor. Lower incisors forming a continuous, broadly U-shaped row between canines, their crowns very slightly imbricated; crowns much longer than high, trifid, that of i_1 narrowest, longest and lowest, that of i_2 and i_3 widened posteriorly but without additional cusps or tubercles. Upper canine robust, the greatest diameter of its crown about three-quarters length of anterior border of shaft, the cross section of shaft broadly triangular with longest side formed by nearly flat postero-internal surface; a sharply defined antero-exteral longitudinal groove, and less definite postero-external concavity; anterior edge narrow but not strictly trenchant; posterior edge trenchant, with well marked angle slightly below middle, this angle frequently becoming a distinct secondary cusp; cingulum well developed but not

forming true basal cusps. Mandibular canine low and heavy, its apex scarcely rising above level of highest molar cusps, its greatest diameter measured along cingulum nearly or quite equal to length of anterior border of shaft; cingulum well developed, forming a distinct antero-basal cusp, the apex of which rises to level of middle of posterior border of shaft. Anterior upper premolar with area of crown approximately equal to that of upper incisor and about one-fifth that of canine. It is somewhat crowded inward from tooth-row, though about half of its crown is visible from outer side in space between canine and large premolar; main cusp short but well developed, lying somewhat in front of middle of crown, the general form of the tooth much like that of canine but proportionally lower. Large upper premolar with crown area about equal to that of canine or slightly greater, the inner portion narrow and flattened-concave, with evident elevated rim, the posterior border strongly concave, the anterior border usually convex but occasionally a little concave; height of main cusp slightly greater than that of highest molar cusps and about equal to length of tooth along outer cingulum, posterior cutting edge well developed; secondary cusp low but evident, rising from cingulum at antero-internal base of main cusp. Lower premolars with crown areas not conspicuously unequal, though that of second perceptibly greater than that of first; outline of crown of each tooth rhombic, the outer border somewhat convex, the anterior border of second relatively shorter than that of first; cingulum well developed, forming a slight antero-internal basal cusp; main cusp triangular in outline when viewed from the side, that of second as high as molar cusps, that of first shorter, the antero-external surface of each tooth convex, the internal and posterior surfaces concave. First and second upper molars sub-equal, though transverse diameter is relatively greater in latter than in former; inner border rather narrowly rounded, the region of greatest convexity a little in front of middle; anterior and posterior borders straight or slightly concave; protocone robust though rather low; hypocone small but well developed, though not completely distinct from posterior commissure of protocone; metacone higher than paracone; styles well developed; W-pattern normal; m^3 with crown area about two-thirds that of m^1, the hypocone absent, the metacone smaller than paracone; no trace of metastyle or fourth commissure. Lower molars with no special peculiarities; protoconid higher than hypoconid in all three teeth; hypoconid with greater basal area than protoconid in m_1 and m_2, but with less in m_3; cingulum well developed, forming a slight postero-internal cusp behind entoconid.

FIG. 35.
Pipistrellus pipistrellus.
Anterior teeth × 5.

Measurements.—Adult male from Henley-on-Thames, Oxford-

shire, England : head and body, 44 ; tail, 32 ; tibia, 10·4 ; foot, 6 ; **forearm**, 30·4 ; thumb, 4·4 ; third finger, 52 ; fifth finger, 38. Two adult males from Sorrento, Italy : head and body, 42 and 43 ; tail, 29 and 32 ; tibia, 10·8 and 10 ; foot, 5·8 and 6·2 ; **forearm**, 30·4 and 31 ; thumb, 4·8 and 4·2 ; third finger, 53 and 53 ; fifth finger, 39 and 38 ; ear from meatus, 11·4 and 11·4 ; width of ear, 8·2 and 8·2. Two adult females from the same locality : head and body, 39 and 40 ; tail 32 and 33 ; tibia, 10·8 and 10·6 ; foot, 6 and 6 ; **forearm**, 32 and 30·2 ; thumb, 5 and 4·4 ; third finger, 58 and 52 ; fifth finger, 41·6 and 40 ; ear from meatus, 12 and 11·2 ; width of ear, 8·4 and 8. Adult female from Burgos, Spain, and adult female from Ciudad Real, Spain : head and body, 49 and 39 ; tail, 31 and 30 ; tibia, 10·6 and 9·6 ; foot, 4·8 and 5·6 ; **forearm**, 32 and 28·8 ; thumb, 5 and 4·6 ; third finger, 57·6 and 51 ; fifth finger, 42 and 38 ; ear from meatus, 10·4 and 10·4. Extremes of twenty males from Florence, Italy : head and body, 33–38 ; tail, 26–31 ; tibia, 9·2–9·6 ; foot, 5·0–5·2 ; **forearm**, 27·6–30 ; thumb, 5·0–5·0 ; third finger, 49–53 ; fifth finger, 34·6–40. For cranial measurements see Table, p. 210.

Specimens examined.—Two hundred and seventy-nine, from the following localities :—

Ireland : Co. Longford, 1 ; Co. Antrim, 1.

England : Alnwick, Northumberland, 1 ; Bowdon, Cheshire, 1 ; Great Grimsby, Lincolnshire, 1 ; Henley-on-Thames, Oxfordshire, 1 (U.S.N.M.) ; Tring, Hertfordshire, 4 : Lilford, Northamptonshire, 2 ; Aberia, Merionethshire, 1 ; Chelmsford, Essex, 2 ; London, 1 ; Wimbledon, Surrey, 1 ; Twigworth, Gloucestershire, 1 ; New Forest, Hampshire, 1 ; Netley, Hampshire, 1 ; Loddiswell, Devonshire, 1.

Sweden : Upsala, 6.

Denmark : Hillerød, Zealand, 1.

France : Boulogne-sur-Mer, Pas-de-Calais, 2 ; Étupes, Doubs, 1 (Mottaz) ; Nîmes, Gard, 3 (Mottaz and Nîmes, the last wrongly marked type of *nigrans* Crespon) ; St. Genies, Gard, 1 (Mottaz) ; Marseilles, 1 (U.S.N.M.)

Germany : Bonn, 4 ; Ingelheim, Rheinhessen, 1 ; Magdeburg, Saxony, 1 ; Berlin, 1 ; Rudolstadt, Bavaria, 3 ; Niesky, Silesia, 1.

Austria-Hungary : Transylvania, 1 ; Zara, Dalmatia, 1.

Switzerland : Geneva, 15 (Mottaz) ; Buchillon, Vaud, 4 (Mottaz) ; Morat, Fribourg, 1 (Mottaz) ; Neuchatel, 1 (Mottaz) ; Cortivallo, Ticino, 1 (U.S.N.M.) ; Mt. San Salvatore, Ticino, 13 (U.S.N.M.).

Italy : Campiglio, Tirol, 1 ; near Genoa, 10 (U.S.N.M. and Genoa) ; Isola Giglio, 2 (Genoa) ; Florence, 103 (U.S.N.M. and Mottaz) ; Rome, 2 (U.S.N.M.) ; Sorrento, 21 (U.S.N.M.) ; Mondulo, Sicily, 1 (U.S.N.M.) ; Palermo, Sicily, 1 (U.S.N.M.) ; Sicily, no exact locality, 1 ; Ustica Island, 1 (U.S.N.M.).

Sardinia : Cagliari, 17 (B.M. and Genoa) ; no exact locality, 2.

Greece : Athens, 1 (U.S.N.M.) ; Tatoi, near Athens, 11 ; Kephissia, near Athens, 4.

Spain : Villalba, Lugo, 1 ; Burgos, 3 ; Silos, Burgos, 2 ; La Granja, Segovia, 4 ; Ciudad Real, Madrid, 2 ; Granada, 1 ; Seville, 1 ; Alcala, near Seville, 1.

Remarks.—*Pipistrellus pipistrellus* is the smallest as well as one of the commonest and most generally distributed of European

CRANIAL MEASUREMENTS OF *PIPISTRELLUS PIPISTRELLUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case at middle.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
England: Lilford, Northamptonshire	11. 1. 1. 125	♀	11·8	—	3·4	4·8	6·4	4·6	8·8	4·2	4·6	Teeth moderately worn.
,, ,,	—		11·2	7·2	3·2	4·6	6·2	4·2	8·0	4·0	4·4	,, slightly worn.
Aberia, Merionethshire	11. 1. 1. 26	♂	11·6	—	3·4	4·8	6·4	4·4	8·4	4·2	4·8	,, ,,
Chelmsford, Essex	—	♀	11·8	—	3·2	4·6	6·4	4·2	8·6	4·2	4·6	,, moderately worn.
Henley-on-Thames	152555	♂	11·4	7·4	3·2	4·4	6·2	4·4	8·2	4·0	4·6	,, slightly worn.
Sweden: Upsala	152553	♀	11·2	7·6	3·4	4·6	6·4	4·4	8·2	4·0	4·2	,, ,,
,,	152554	♀	11·6	7·8	3·2	4·6	6·2	4·4	8·2	4·2	4·4	,, ,,
,,	11. 1. 1. 28	♀	11·2	7·6	3·2	4·6	6·2	4·4	8·4	4·2	4·2	,, ,,
,,	11. 1. 1. 27		11·6	7·8	3·2	4·6	6·2	4·2	8·4	4·2	4·4	,, ,,
,,	—		11·6	—	3·4	4·8	6·4	4·4	8·2	4·2	4·6	,, ,,
,,	11. 1. 1. 26	♀	11·4	7·6	3·4	4.6	6·2	4·2	8·0	4·2	4·4	,, ,,
Denmark: Hilleröd, Zealand	98. 6. 7. 1	♂	11·2	7·6	3·6	4·6	6·4	4·2	8·0	4·0	4·4	,, ,,
France: Boulogne-sur-Mer, Pas-de-Calais	98. 1. 9. 2	♀	11·8	7·8	3·4	4·6	6·4	4·4	8·4	4·2	4·6	,, not worn.
Germany: Berlin	66. 2. 1. 23	♂	11·0	7·2	3·2	4·4	6·2	4·2	8·0	4·0	4·4	,, ,,
Rudolstadt, Thüringen	95. 4. 18. 4	♂	11·4	—	3·4	4·4	6·2	4·0	8·2	4·0	4·6	,, ,,
,, ,,	95. 4. 18. 5	♀	11·6	7·2	3·6	4·8	6·4	4·2	8·2	4·2	4·8	,, moderately worn.

Germany: Rudolstadt, Thüringen	95. 4. 18. 6	♀	11·4	7·4	3·6	4·6	6·4	4·2	8·2	4·2	4·6	Teeth not worn.
Niesky, Silesia . .	97. 12. 4. 6	♀	11·2	7·6	3·6	4·8	6·4	4·2	8·2	4·0	4·6	,, slightly worn.
Spain: Burgos . . .	8. 8. 4. 14	♀	11·4	7·4	3·4	4·6	6·2	4·0	8·4	4·2	4·6	,, not worn.
Ciudad Real, Madrid .	8. 7. 23. 3	♀	11·0	7·2	3·4	4·6	6·2	4·0	8·0	4·0	4·2	,, moderately worn.
Italy: Borzoli, Liguria . .	Genoa 82	♂	11·0	7·2	3·2	4·4	6·0	4·2	8·0	4·0	4·4	,, slightly worn.
,, ,, . .	,, 154	♂	11·4	7·2	3·2	4·4	6·2	4·4	8·2	4·0	4·4	,, moderately worn.
,, ,, . .	,, 153	♀	11·2	—	3·2	4·4	6·2	4·2	8·0	4·0	4·4	,, slightly worn.
,, ,, . .	,, 152	♀	11·6	—	3·2	4·6	6·2	4·4	8·4	4·0	4·4	,, ,,
Isola Giglio . . .	,, 02	♀	11·8	7·6	3·2	4·6	6·2	4·2	8·6	4·2	4·6	,, much worn.
,, ,, . .	,, 4	♀	11·2	—	3·2	4·4	6·2	—	8·0	4·0	4·4	,, slightly worn.
Sardinia: near Cagliari . .	,, 0	♀	11·4	—	3·2	4·4	6·2	4·2	8·0	4·0	4·4	,, ,,
,, . .	,, P	♀	11·6	7·4	3·4	4·4	6·2	4·6	8·0	4·0	4·4	,, not worn.
,, . .	,, 9	♀	11·6	—	3·2	4·6	6·2	4·2	8·4	4·2	4·4	,, slightly worn.
Sicily: Palermo	103323	♀	11·4	7·2	3·2	4·2	6·0	4·2	8·0	4·0	4·2	,, ,,
Ustica Island . . .	113898	♂	11·0	7·2	3·2	4·2	6·0	4·4	8·2	4·0	4·2	,, not worn.
Greece: Tatoi, near Athens . .	152566	♀	11·8	7·8	3·2	4·6	6·2	4·2	8·6	4·2	4·6	,, ,,
,, ,, . .	152567	♀	11·0	—	3·2	4·4	6·2	4·2	8·0	4·0	4·4	,, ,,
,, ,, . .	152568	♀	11·2	—	3·2	4·4	6·0	4·2	8·2	4·0	4·4	,, slightly worn.
,, ,, . .	8. 10. 2. 19	♀	11·6	7·6	3·2	4·6	6·4	4·2	8·6	4·2	4·6	,, ,,
,, ,, . .	152569	♀	11·4	7·4	3·2	4·4	6·2	4·2	8·2	4·2	4·4	,, not worn.
,, ,, . .	8. 10. 2. 20	♀	11·4	—	3·2	4·4	6·2	4·2	8·2	4·2	4·4	,, slightly worn.
,, ,, . .	8. 10. 2. 21	♀	11·4	7·4	3·2	4·6	6·2	4·4	8·2	4·2	4·4	,, not worn.

bats. Superficially it may be distinguished from the almost equally small *Myotis mystacinus* by its smaller ears and shorter legs; but for positive discrimination from the members of the genus *Pipistrellus* recourse to the more technical characters of skull and teeth is necessary. On superficial examination it may usually be recognized among its congeners by its small size, and by the shortness of the fifth finger.

♂ al.	Co. Longford, Ireland.	Dr. G. E. Dobson (P).	76. 2. 12. 1.
♀ st.	Co. Antrim.	Hon. N. C. Rothschild (P).	1. 9. 3. 6.
♀.	Alnwick, Northumberland, England.	W. E. de Winton (P).	11. 1. 3. 390.
2 ♂, 2 ♀.	Tring, Hertfordshire.	Hon. N. C. Rothschild (P).	9. 2. 19. 1–4.
♀.	Lilford, Northamptonshire.	Lord Lilford (P).	11. 1. 1. 125.
2 ♀.	Chelmsford, Essex.	M. Christy and E. L. Thompson (P).	11. 1. 3. 23–24.
♀ juv. al.	London.	Dr. A. Günther (P).	74. 7. 6. 1.
♂.	Wimbledon, Surrey.	C. H. B. Grant (C & P).	11. 1. 3. 27.
juv.	New Forest, Hampshire.	Col. J. W. Yerbury (C & P).	11. 1. 3. 389.
♀ al.	Netley, Hampshire.	Dr. G. E. Dobson (C & P).	76. 11. 3. 1.
♀.	Loddiswell, Devonshire.	Col. J. W. Yerbury (C & P).	11. 1. 3. 25.
3 ♀.	Upsala, Sweden. (*Kolthoff.*)	Lord Lilford (P).	11. 1. 1. 26–28.
♂.	Hilleröd, Zealand, Denmark.	O. Thomas (C & P).	96. 6. 7. 1.
♂, ♀.	Boulogne, Pas-de-Calais, France.	O. Thomas (C & P).	98. 1. 9. 1–2.
♂, ♀ al.	Bonn, Rhineland, Germany.	Dr. A. Günther (P).	
♀.	Ingelheim, Rheinhessen.	C. H. Hilgert (C).	8. 11. 2. 3–4.
♀ al.	Magdeburg, Saxony.	Dr. W. Wolterstorff (P).	92. 12. 1. 2.
♂ al.	Berlin.	Dr. A. Günther (P).	66. 2. 1. 22.
♀ al.	Transylvania, Hungary.	C. G. Danford and J. A. Brown (C & P).	74. 7. 4. 6.
♂.	Zara, Dalmatia.	Lord Lilford (P).	11. 1. 1. 29.
2 al.	Ciudad Real, Spain.	A. Cabrera (P).	8. 7. 23. 2–3.
♀.	Burgos, Prov. Burgos.	G. S. Miller (C).	8. 8. 4. 14.
♀.	Silos, Burgos.	G. S. Miller (C).	8. 8. 4. 15.
1 al.	Campiglio, Tirol, Italy.	G. C. Champion (C & P).	96. 8. 7. 1.
♂ juv. al.	Sicily.	———	46. 6. 15. 6.
14 al.	Aristano, Cagliari, Sardinia. (*C. Krausse.*)	Hon. N. C. Rothschild (P).	7. 5. 24. 11–24.
2 juv. al.	Sardinia. (*P. Bonomi.*)	E. N. Buxton (P).	95. 4. 16. 4–5.
3 ♀.	Tatoi, Athens, Greece. (*C. Mottaz.*)	Hon. N. C. Rothschild (P).	8. 10. 2. 19–21.
♂, 3 ♀.	Kephissia, Athens.	C. Mottaz (C).	8. 11. 3. 4–7.

PIPISTRELLUS NATHUSII Keyserling and Blasius.

1839. V[*espertilio*] *nathusii* Keyserling and Blasius, Wiegmann's Archiv für Naturgesch., 1839, I, p. 320 (Berlin, Germany).

1857. *Vesperugo nathusii* Blasius, Säugethiere Deutschlands, p. 58.

1878. *Vesperugo abramus* Dobson, Catal. Chiropt. Brit. Mus., p. 226 (Part: not of Temminck).

1900. *Pipistrellus nathusii* Méhely, Monogr. Chiropt. Hungariæ, p. 276.

1905. *Vesp[erugo] nathusii* var. *unicolor* Fatio, Arch. Sci. Phys. et Nat., Genève, 4th ser., XIX, p. 510, May, 1905 (Geneva, Switzerland). Type in Geneva Museum.

1910. *Pipistrellus abramus* Trouessart, Faune Mamm. d'Europe, p. 16.

Type locality.—Berlin, Germany.

Geographical distribution.—Central and southern Continental Europe; exact limits of range not known.

Diagnosis.—Not so small as *Pipistrellus pipistrellus* (forearm, 32 to 35 mm.; condylobasal length of skull, 12·6 to 13·4 mm.), which in general it resembles, but: small upper premolar better developed, the greatest diameter of its crown nearly half that of canine; canines both above and below much more slender, the length of base of lower tooth measured along cingulum slightly more than half length of anterior border; tragus more slender, its greatest width much less than length of anterior border; thumb long, its length much greater than width of wrist; length of fifth finger about 46 mm.; posterior edge of wing membrane always pale, though never sharply defined white.

External characters.—In general and apart from the animal's less diminutive size, the external characters are essentially as in *Pipistrellus pipistrellus*. Ear larger and broader with more obtuse apex, more evidently concave posterior border, the inner surface of conch more rugose and with about four irregular cross striations behind tragus; antitragus small but well defined, projecting distinctly beyond border of conch; tragus about as high as in *P. pipistrellus* and similarly blunt at tip, but with posterior border more evidently convex; posterior basal lobe small, usually less well defined than in *P. pipistrellus*. Wing larger and relatively broader than in *P. pipistrellus*, the metacarpals as in the smaller animal, but fifth finger extending beyond elbow to a distance equal to decidedly more than one-third length of forearm; thumb less shortened than in the other European members of the genus, its length noticeably greater than width of wrist; membrane inserted at base of outer toe. Foot, calcar and tail as in *P. pipistrellus*.

Fur and colour.—Fur slightly more loose in texture than that of *P. pipistrellus*, the individual hairs somewhat longer, those at middle of back about 7 mm. in length. In distribution it shows no peculiarities, though it extends perhaps less widely on dorsal surface of interfemoral membrane. Colour essentially like that of *Pipistrellus pipistrellus*, though usually distinguishable by a

tendency away from the cinnamon and raw-umber tints toward a clearer brown more resembling Ridgway's mars-brown. Membranes less blackish than in *P. pipistrellus*, the wing from foot nearly to fifth finger with a noticeable pale border about 1 mm. in width, similar to that present in *P. kuhlii*, but less sharply defined and less nearly white.

Skull.—The skull is less diminutive than that of *Pipistrellus pipistrellus*, its general size about as *Myotis mystacinus*. General form less robust than in *P. pipistrellus*, the width of brain-case barely one-half greatest length, but more contrasted with that of rostrum. Dorsal profile as in the smaller species, but with more evident anterior concavity and posterior convexity, the anterior edge of interparietal indicated by a slight transverse constriction. Other details of form essentially as in *P. pipistrellus*.

Teeth. As compared with those of *Pipistrellus pipistrellus* the teeth throughout show a tendency toward slenderness and height. Inner upper incisor noticeably more slender than that of *P. pipistrellus*, and with less well developed secondary cusp; outer upper incisor distinctly larger than inner, its apex extending noticeably beyond secondary cusp of inner tooth, its general form essentially as in *P. pipistrellus*, but inner margin without evident secondary cusp. Lower incisors less crowded than in *P. pipistrellus*, a slight space usually present in median line, another between i_2 and i_3, and another between i_3 and canine; outer edge of i_1 slightly overlapping i_2; in form the teeth are not peculiar. Upper canine like that of *P. pipistrellus*, except that the greatest diameter of its crown is only about half length of anterior border of shaft. Mandibular canine high and slender, its apex rising distinctly above that of highest molar cusps, its greatest diameter measured along cingulum equal to a little more than half length of anterior border; apex of anterior cingulum cusp not rising above level of basal third of posterior border. Upper premolars as in *P. pipistrellus*, except that the small tooth is relatively higher and more perfectly in the tooth-row, and the posterior border of its shaft usually shows some indication of an angular secondary cusp corresponding to that of canine. Lower premolars with crown area more nearly equal than in the smaller species, but without special peculiarities of form. Molars both above and below essentially similar to those of *P. pipistrellus*.

FIG. 36.
Pipistrellus nathusii.
Anterior teeth × 5.

Measurements.—Adult male from Berlin, Germany (topotype): head and body, 45; tail, 35·4; tibia, 13; foot, 6·8; forearm, 33; thumb, 5·2; third finger, 65; fifth finger, 47; ear from meatus, 12; width of ear, 11. Average and extremes of six adults from Buchillon, Vaud, Switzerland: tibia, 12·9 (12·6–14); foot, 7·3 (6·8–7·6); forearm, 33 (32·4–34·6); thumb, 5·7

(5·2–6); third finger, 61·3 (58–65); fifth finger, 44·6 (41–47). Adult male and female from Florence, Italy: head and body, 46 and 47; tail, 40 and 38; tibia, 12·8 and 12·6; foot, 6·8 and 7; forearm, 35 and 33; thumb, 6·2 and 6·6; third finger, 63 and 62; fifth finger, 47 and 46; ear from meatus, 12·6 and 12·6; width of ear, 11 and 11·4. For cranial measurements see Table, p. 222.

Specimens examined.—Thirty-three, from the following localities:—

France: St. Gilles, Gard, 1.

Germany: Berlin, 1; Bavaria, 1 (U.S.N.M.); Ingelheim, Rheinhessen, 1.

Switzerland: Geneva, 6 (Mottaz and Geneva, including type of *unicolor* Fatio); Montreux, Vaud, 1 (Mottaz); Buchillon, Vaud, 6 (Mottaz); Neuchatel, 1 (U.S.N.M.); Canton Uri, 1; St. Gothard, Uri, 1 (U.S.N.M.).

Austria-Hungary: Palics, Bacser, southern Hungary, 2.

Italy: Siena, 1 (U.S.N.M.); Florence, 3 (U.S.N.M.); Rome, 5 (B.M. and U.S.N.M.); Borzoli, Liguria, 1; Catanzaro, Calabria, 1 (U.S.N.M.).

Remarks.—Though readily distinguishable from the other European members of the genus by its cranial and dental characters, *Pipistrellus nathusii* is superficially much like *P. pipistrellus*. It is usually recognizable, however, by its slightly less diminutive size, more robust form, and by the constant presence of an ill-defined light (though never actually whitish) border to the wing.* As pointed out by Méhely in 1900 it has no very near relationship to the Oriental *P. abramus*.

♂.	St. Gilles, Gard, France.	G. S. Miller (C).	8. 8. 4. 128.
♂ al.	Berlin, Germany.	Dr. Günther (C & P).	66. 2. 1. 22.
♀.	Ingelheim, Rheinhessen.	C. Hilgert (C).	8. 11. 2. 3.
2 al.	Palics, Bacser, Hungary.	Budapest Museum (E).	0. 4. 9. 1–2.
♂.	Canton Uri, Switzerland.	Tomes Collection.	7. 1. 1. 398.
♂, ♀.	Rome. (*C. Coli.*)	G. Barrett-Hamilton (P).	11. 1. 2. 20–21.
♀.	Borzoli, Liguria, Italy.	Marquis G. Doria (C & P).	5. 12. 15. 7.

PIPISTRELLUS KUHLII Kuhl.

1819. *Vespertilio kuhlii* Kuhl, Ann. Wetterau. Gesellsch. Naturk., IV (= Neue Ann., I), pt. 2, p. 199 (Triest).

1835. *Vesp[ertilio] albolimbatus* Küster, Isis, p. 75 (Cagliari, Sardinia).

1837. *Vespertilio vispistrellus* Bonaparte, Iconogr. Faun. Ital., I, fasc. XX (near Rome, Italy). Type in British Museum.

1837. *Vespertilio alcythoe* Bonaparte, Iconogr. Faun. Ital., I, fasc. XXI (Sicily.) Type in British Museum.

1838. *Romicia calcarata* Gray, Mag. Zool. and Bot., II, p. 495 (locality unknown).

1841. *Pipistrellus marginatus* Bonaparte, Iconogr. Fauna. Ital., Indic. distrib., nomencl. mod. (Substitute for *albolimbatus*).

1844. *Vespertilio marginatus* Wagner, Schreber's Säugthiere, Suppl., I, p. 503, pl. LV A. No description. Name occurs in synonymy of *kuhlii* with Michahelles as authority, and on plate. Apparently not previously published.

* A light border sometimes occurs in *P. pipistrellus*, but is rare. That constantly present in *P. kuhlii* is more sharply defined and more truly whitish than in *P. nathusii*.

1840. V[espertilio] *ursula* Wagner, Schreber's Säugthiere, Suppl., I, p. 505 (Morea, Greece).
1857. *Vesperugo kuhlii* Blasius, Säugethiere Deutschlands, p. 63.
1878. *Vesperugo kuhlii* Dobson, Catal. Chiropt. Brit. Mus., p. 230.
1886. [*Vesperugo kuhlii*] var. *albicans* Monticelli, Atti Soc. Ital. Sci. Nat., Milano, XXVII, p. 200, March, 1886 (Caivano, Naples, Italy).
1886. [*Vesperugo kuhlii*] var. *pallatus* Monticelli, Atti Soc. Ital. Sci. Nat., Milano, XXVII, p. 200, March, 1886 (Bella Vista, near Portici, Naples, Italy).
1900. *Pipistrellus kuhlii* Méhely, Monogr. Chiropt. Hungariæ, p. 261.
1910. *Pipistrellus kuhli* Trouessart, Faune Mamm. d'Europe, p. 17.

Type locality.—Trieste, Austria-Hungary.

Geographical distribution.—Mediterranean region and eastward into Asia.

Diagnosis.—Size about as in *Pipistrellus nathusii* (forearm, 31 to 35 mm.; condylobasal length of skull, 12·0 to 13·2 mm.); outer upper incisor less than half as high as inner incisor; large upper premolar almost or quite in contact with canine, the small premolar forced inward from tooth-row and scarcely or not visible from outer side, its greatest diameter about equal to that of outer incisor; canines less robust than in *P. pipistrellus*, less slender than in *P. nathusii*; tragus with greatest width less than length of anterior border; thumb short, its length about equal to width of wrist; posterior edge of wing membrane with sharply defined whitish border.

External characters.—General form very similar to that of *Pipistrellus pipistrellus*, the wing similarly narrow as compared with that of *P. nathusii*. Ear narrowly rounded at tip, the posterior border slightly concave; antitragus slightly developed, producing an evident break in contour of conch; inner surface of conch somewhat rugose, without well defined transverse striations; tragus essentially as in *P. nathusii*, the posterior border noticeably convex. Wing, foot, calcar and tail as in *P. pipistrellus*.

Fur and colour.—Quality and distribution of fur essentially as in *Pipistrellus pipistrellus*, but dorsal surface of interfemoral membrane haired scarcely beyond basal third. Colour not very different from that of *Pipistrellus pipistrellus*, but somewhat lighter and more yellow, often approaching raw-siena. Membranes blackish, the wing between foot and fifth finger with a sharply defined very narrow (less than 1 mm.) nearly white border.

Skull.—The skull resembles that of *Pipistrellus nathusii* in size, but its form is even more robust than that of *P. pipistrellus*. Dorsal profile with very slight interorbital concavity and barely perceptible convexity over middle of brain-case. Breadth of brain-case about half greatest length of skull. Dorsal surface of rostrum less rounded off at sides than in *P. pipistrellus* and *P. nathusii*, but not so much flattened as in *P. savii*. Narial emargination more abruptly narrowed posteriorly than in the

other European species. Mesopterygoid space slightly longer than wide. Mandible with coronoid process distinctly higher than articular process, so that upper edge of posterior portion is obliquè and not parallel with alveolar line.

Teeth.—Inner upper incisor essentially as in *Pipistrellus pipistrellus* except that secondary cusp is reduced to a minute, sometimes obsolete, projection from cingulum at posterior base of shaft; outer incisor very small, less than half as high as inner, its apex about on level with highest point of cingulum of larger tooth, its crown area about two-thirds that of latter, its structure essentially as in *P. pipistrellus*, though with very small secondary cusp; small tooth situated directly exterior to large, so that a line perpendicular to main axis of skull would pass through middle of all four incisors; lower incisors essentially as in *P. pipistrellus*, though relatively larger and more strongly imbricated. Canines both above and below intermediate in form between those of *P. pipistrellus* and *P. nathusii*. Anterior upper premolar crowded inward from tooth-row and closely wedged between canine and large premolar which are nearly or quite in contact; the small tooth is usually though not always invisible from outer side, its cusp is very low, nearly terete, its crown area about equal to that of outer incisor; large premolar with no special peculiarities. Lower premolars as in the related species, but disproportion in size more marked, the crown area of first a little more than half that of second. Molars both above and below essentially as in *P. pipistrellus* and *P. nathusii*, but somewhat more robust.

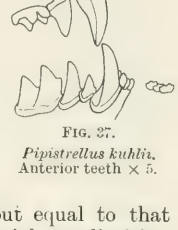

Fig. 37.
Pipistrellus kuhlii.
Anterior teeth × 5.

Measurements.—Two adult males from near Genoa, Italy: head and body, 43 and 46; tail, 37·4 and 38; tibia, 12·4 and 13; foot, 6 and 6; **forearm**, 33·6 and 34; thumb, 5 and 5·2; third finger, 60 and 60; fifth finger, 45 and 44; ear from meatus, 12·6 and 13; width of ear, 10·4 and 10. Two adult females from the same locality: head and body, 44 and 47; tail, 39 and 40; tibia, 12 and 13; foot, 6·2 and 6·2; **forearm**, 33·4 and 35; thumb, 5·2 and 5·4; third finger, 60 and 63; fifth finger, 45 and 47; ear from meatus, 13 and 13; width of ear, 10 and 10. Adult male and female from Palermo, Sicily: head and body, 42 and 44; tail, 36 and 35·4; tibia, 12·4 and 12·4; foot, 5·6 and 5·4; **forearm**, 31 and 34; thumb, 5·4 and 5·2; third finger, 56 and 61; fifth finger, 41 and 43·6; ear from meatus, 12·4 and 13; width of ear, 10 and 10. Adult male and female from Cagliari, Sardinia: head and body, 44 and 45; tail, 35 and 37; tibia, 12·6 and 12·4; foot, 6·2 and 6·8; **forearm**, 33 and 33; thumb, 5 and 5; third finger, 58 and 62; fifth finger, 43 and 45; ear from meatus, 13 and 12; width of ear, 10 and 10. For cranial measurements see Table, p. 218.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case at middle.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
Balearic Islands: San Cristobal, Minorca	0. 7. 1. 29	♂	12·6	8·6	3·2	4·2	6·8	4·4	9·8	5·0	5·2	Teeth not worn.
France: St. Gilles, Gard	172128	♀	13.2	8·8	3·2	5·0	6·6	4·4	10·0	5·0	5·4	,, slightly worn.
Italy: Perti, Finalborgo	Genoa 4	♂	12·8	8·6	3·2	4·6	6·8	4·6	9·6	5·0	5·2	,, ,,
,, ,,	,, 5	♂	12·4	8·2	3·4	4·8	6·6	4·6	9·6	5·0	5·2	,, not worn.
,, ,,	,, —	♀	13·0	—	3·6	4·8	6·6	4·6	9·8	5·0	5·4	,, ,,
,, ,,	,, 3	♀	12·6	8·0	3·2	4·8	6·4	4·6	9·8	5·0	5·2	,, moderately worn.
Siena	98. 10. 2. 3	♂	12·0	7·6±	3·6	4·8	6·4	4·6	9·0	4·8	5·0	,, not worn.
,,	113887	♀	12·2	8·2	3·4	4·6	6·4	4·6	9·2	4·8	5·0	,, slightly worn.
,,	113889	♀	12·2	8·2	3·2	4·6	6·6	4·6	9·0	4·8	5 0	,, ,,
,,	113891	♀	12·2	8·0	3·2	4·2	6·4	4·4	9·0	4·8	5·0	,, much worn.
Rome	113886	♀	12·4	8·2	3·2	4·6	6·4	4·4	9·4	4·8	5·2	,, not worn.
,,	113875	♂	12·4	8·2	3·2	4·8	6·4	4·8	9·4	4·8	5·2	,, slightly worn.
Sorrento	102954	♂	12·4	8·2	3·2	4·8	6·6	4·6	9·2	5·0	5·2	,, ,,
,,	102950	♀	12·4	8·4	3·4	5·0	6·6	4·8	9·6	5·0	5·4	,, ,,
Catanzaro, Calabria	113880	♂	12·2	7·8	3·2	5·0	6·4	4·6	9·2	4·8	5·2	,, not worn.
,, ,,	113881	♂	12·0	8·0	3·2	4·6	6·4	4·6	9·0	4·8	5·0	,, slightly worn.
,, ,,	113883	♂	12·6	8·2	3·4	4·6	6·6	4·8	9·6	5·0	5·2	,, ,,
,, ,,	113884	♀	12·4	8·0	3·2	4·4	6·4	4·8	9·2	4·8	5·0	,, not worn.
Sicily: Palermo	103320		12·4	8·2	3·4	4·4	6·4	4·8	9·6	4·8	5·2	,, slightly worn.
,,	103324	♀	12·4	8·2	3·4	4·6	6·8	4·8	9·6	4·8	5·2	,, ,,
,,	103325	♀	12·2	8·2	3·2	4·2	6·4	4·8	9·4	5·0	5·2	,, not worn.
Ustica Island	113893	♂	12·2	8·2	3·2	4·4	6·4	4·6	9·2	4·8	5·0	,, ,,
Sardinia: Mt. Gennargentu	86542		12·6	8 0	3·2	4·6	6·6	4·6	9 2	5·0	5·2	,, ,,
,, ,,	86543	♂	12·8	8·2	3·2	5·0	6·8	4·6	9·8	5·0	5·4	,, ,,
,, ,,	86546	♀	12·8	8·2	3 2	5·0	6 4	4·6	9·6	5·0	5·2	,, slightly worn.
Greece: Corfu	8. 10. 1. 4	♂	12·2	8·4	3·4	4·8	6·8	4.6	9·2	5·0	5·2	,, not worn.
,,	8. 10. 1. 5	♀	12·6	8·4	3·4	5·0	6·8	4·4	9·2	4·8	5·0	,, ,,
Argostoli, Cephalonia	152558	♂	12·6	8·4	3·2	4·6	6·6	4·6	9·6	4·8	5·2	,, ,,
,, ,,	152559	♂	12·8	8·8	3·2	4·8	6·6	4·8	9·6	4·8	5·2	,, ,,
,, ,,	152563	♀	12·8	8·4	3·2	4·6	6·8	4·6	9·8	5·0	5·4	,, ,,

Specimens examined.—One hundred and eight, from the following localities:—

FRANCE: St. Gilles, Gard, 2; Nîmes, Gard, 3 (Mottaz); St. Genies, Gard, 4 (Mottaz); Marseilles, 1 (U.S.N.M.).

SWITZERLAND: Coremmo, Ticino, 1 (Mottaz); Lugano, Ticino, 1 (Mottaz).

ITALY: Near Genoa, 14 (U.S.N.M. and Genoa); Siena, 6 (B.M. and U.S.N.M.); Florence, 1 (U.S.N.M.); Rome, 6 (B.M. and U.S.N.M.); near Rome 1 (type of *vispistrellus* Bonaparte); Sorrento, 3 (U.S.N.M.); Catanzaro, Calabria, 6 (U.S.N.M.); Palermo, Sicily, 23 (U.S.N.M.); Corleone, Sicily, 1 (U.S.N.M.); Ustica Island, Sicily, 4 (U.S.N.M.); Sicily, 1 (type of *alcythoe* Bonaparte).

SARDINIA: Cagliari, 4 (U.S.N.M.); Mt. Gennargentu, 7 (U.S.N.M.); no exact locality, 2.

GREECE: Corfu, 2; Cephalonia, 10; Patras, 3.

SPAIN: San Cristobal, Minorca, Balearic Islands, 2.

Remarks.—*Pipistrellus kuhlii* is easily recognizable by the form and relative size of the upper incisors. Externally it may usually be known by the sharply defined whitish border to the wing membrane, though too much reliance should not be placed on this character alone. Many specimens from Sardinia are lighter in colour than those from the mainland. These represent the *albolimbatus* of Küster. Normally coloured examples also occur; and in the absence of adequate material it has seemed preferable for the time being not to attempt to define the insular form.

♂.	St. Gilles, Gard, France.	G. S. Miller (c).	8. 8. 4. 127.
♂.	Siena, Italy. (*S. Brogi.*)	Dr. E. Hamilton (p).	98. 10. 2. 2.
3 ♂, ♀.	Rome. (*C. Coli.*)	G. Barrett-Hamilton (p).	11. 1. 2. 16–19.
skeleton without skull.	Sicily. (*Prince Bonaparte.*)	Tomes Collection. (*Type* of *V. alcythoe* Bonaparte.)	7. 1. 1. 730.
skeleton without skull.	Near Rome, Italy. (*Prince Bonaparte.*)	Tomes Collection. (*Type* of *V. vispistellus* Bonaparte.)	7. 1. 1. 729.
♂, ♀.	Corfu, Greece. (*C. Mottaz.*)	J. I. S. Whitaker (p).	8. 10. 1. 4–5.
3 ♂.	Argostoli, Cephalonia. (*C. Mottaz.*)	J. I. S. Whitaker (p).	8. 10. 1. 1–3.
♂, ♀.	Patras. (*C. Mottaz.*)	Hon. N. C. Rothschild (p).	8. 10. 2. 17–18.
2 ♂.	San Cristobal, Minorca, Balearic Islands.	O. Thomas and R. I. Pocock (c & p).	0. 7. 1. 29–30.

PIPISTRELLUS SAVII Bonaparte.

1837. *Vespertilio savii* Bonaparte, Iconogr. Faun. Ital., I, fasc. XX (Pisa). Type in British Museum.

1837. *Vespertilio aristippe* Bonaparte, Iconogr. Faun. Ital., I, fasc. XXI (Sicily).

1837. *Vespertilio leucippe* Bonaparte, Iconogr. Faun. Ital., I, fasc. XXI (Sicily). Type in British Museum.

1838. *Vespertilio bonapartii* Savi, Nuovo Giorn. de' Letterati, Pisa, XXXVII, p. 226 (Tuscany).

1844. *Vesp[ertilio] nigrans* Crespon, Faune Méridionale, I, p. 24 (Nîmes, Gard, France).
1853. *Vesperugo maurus* Blasius, Wiegmann's Archiv für Naturgesch., 1853, I, p. 35 (Central chain of the Alps).
1857. *Vesperugo maurus* Blasius, Säugethiere Deutschlands, p. 67.
1872. *V[espertilio] agilis* Fatio, Faune Vert. Suisse, Append. au vol. I, p. iii (Alternative name for *V. savii* Bonaparte, ex Savi MS.).
1878. *Vesperugo maurus* Dobson, Catal. Chiropt. Brit. Mus., p. 218.
1904. *Vespertilio ochromixtus* Cabrera, Mem. Soc. Españ. Hist. Nat., II, p. 267 (Sierra de Guadarrama, Madrid, Spain).
1910. *Pipistrellus savii* and *P. savii ochromixtus* Trouessart, Faune Mamm. d'Europe, pp. 13–14.

Type locality.—Pisa, Italy.

Geographical distribution.—Southern Europe, west to the Iberian Peninsula, north to the Alps; also the Canary Islands, northern Africa and southern Asia. Limits of range very imperfectly known.

Diagnosis.—Largest European member of the genus (condylobasal length of skull, 13 to 14 mm.; forearm, 31 to 33 mm.); outer upper incisor more than half as high as inner; large premolar broadly in contact with canine, the small tooth very minute, crowded inward from axis of tooth-row, invisible from outer side and occasionally covered by the gum, its diameter much less than that of outer incisor; anterior lower premolar with crown area less than half that of succeeding tooth; lower canine robust; tragus with greatest width nearly equal to length of anterior border; thumb short; hairs of back usually with contrasting light brown tips.

External characters.—Ear broad, its general form about as in *Pipistrellus nathusii*, the posterior border slightly but evidently concave above middle, the inner surface of conch noticeably rugose and with faint, irregular transverse ridges behind tragus; antitragus small and ill-defined, but producing an evident break in outline of conch; tragus less than half as high as conch, very wide (greatest width, at level of middle of anterior border, nearly equal to length of anterior border), the anterior border nearly straight, the posterior border strongly and evenly convex from tip to notch above small basal lobe. Wing, foot, calcar and tail as in *P. pipistrellus*.

Fur and colour.—The fur resembles that of *Pipistrellus kuhlii* in quality and distribution. Colour differing from that of the other European species in the evident contrast between light tips of hairs of back and darker ground tint. It is also the only species in which there is much individual variation in colour. Four specimens from the neighbourhood of Genoa are coloured as follows: male, not fully adult, uniform very dark vandyke-brown, the extreme tips of hairs of back faintly lighter, underparts a light brown faintly overlaid on blackish under colour; adult male: light tips on back well developed, giving general colour to region, between raw-umber and clay-colour; adult male: light tips very

conspicuous, a peculiar dull brownish ochraceous-buff; adult female: light tips as conspicuous as in last, dull brownish cream-buff.

Skull.—The skull is slightly larger than that of *Pipistrellus nathusii* and *P. kuhlii*, and is immediately distinguishable among the European species by the flatness of dorsal surface of rostrum, prominence of ridge along edge of orbit, and relatively small size of narial emargination, characters the first two of which suggest *Verpertilio murinus*. Dorsal profile of skull as in *P. pipistrellus* and *P. kuhlii*, but brain-case slightly more depressed. Breadth of brain-case about half greatest length of skull. Rostrum relatively broader than in the other European species, its dorsal surface more flattened and orbital ridges more prominent; narial emargination scarcely larger than in *P. pipistrellus*. Mesopterygoid space about as wide as long, its general outline, aside from the notch caused by median spine of palate, broadly barrel shape, the hamulars distinctly turned inward. Mandible with coronoid process and upper border of posterior portion as in *P. kuhlii*, but with angular process less curved and relatively longer than in the other European species.

FIG. 38.
Pipistrellus savii.
Nat. size.

Teeth.—Incisors both above and below essentially as in *Pipistrellus pipistrellus*, except that inner upper tooth has the secondary cusp somewhat better developed. Canines with no special peculiarities, not essentially different from those of *P. pipistrellus*. Anterior upper premolar very minute, sometimes hidden in the gum or occasionally absent, its crown area never much more one-sixth that of outer incisor; large premolar always strongly in contact with canine, its form peculiar in the absence or slight development of the antero-internal cusp. Lower premolars strongly contrasted in size, the crown area of first decidedly less than half that of second, its cusp relatively lower and less developed than in any of the other European species. Molars both above and below with no special peculiarities.

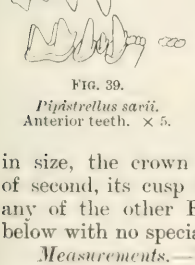

FIG. 39.
Pipistrellus savii.
Anterior teeth. × 5.

Measurements.—Two adult males from Palermo, Sicily: head and body, 43 and 47; tail, 34 and 35; tibia, 12·6 and 12·8; foot, 6·4 and 7; **forearm**, 31 and 32·6; thumb, 5 and 5·6; third finger, 54 and 56; fifth finger, 42 and 41; ear from meatus, 12·4 and 12·6; width of ear, 12 and 12. Two adult females from the same locality: head and body, 46 and 47; tail, 35 and 39; tibia, 13 and 13·4; foot, 6·6 and 7; **forearm**, 33 and 33; thumb, 5 and 5·4; third finger, 56 and 57; fifth finger, 42 and 43; ear from meatus, 12·4 and 13; width of ear, 12 and 11·6.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case at middle.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
P. nathusii.												
Italy: no exact locality . .	5. 12. 15. 7		13·0	8·2	3·8	5·0	7·0	4·6	9·2	4·6	5·0	Teeth not worn.
Catanzaro, Calabria .	113885		12·8	8·0	4·0	5·0	7·0	4·8	9·2	4·4	4·8	,, ,,
Rome	113876		12·6	8·2	3·8	4·6	7·0	4·8	9·2	4·6	4·8	,, ,,
,, ...	113877		12·6	8·2	4·0	4·8	7·0	4·8	9·2	4·4	4·6	,, ,,
,, ...	113878		12·8	—	3·6	4·8	7·0	4·6	9·2	4·6	4·8	,, ,,
Florence . . .	38355	♂	12·6	—	3·8	5·0	7·2	5·0	8·8	4·6	4·8	,, ,,
,, . . .	105299	♀	12·4	—	3·6	4·8	6·8	4·8	8·8	4·6	4·8	,, ,,
,, . . .	105300	♀	13·0	8·2	3·8	5·0	6·8	4·8	—	4·6	4·8	,, ,,
Siena	113890	♀	12·8	7·6	4·0	5·0	7·0	4·8	9·0	4·8	—	,, ,,
France: St. Gilles, Gard. .	8. 8. 4. 128	♂	13·0	8·4	3·9	5·2	7·2	5·0	9·4	5·0	4·8	,, ,,
Switzerland: . .	2347 Mottaz		12·8	8·0	4·0	5·0	6·8	4·6	9·2	4·6	4·8	,, ,,
. .	2346 Mottaz		13·4	8·4	4·0	5·0	7·2	4·8	9·6	4·8	5·0	,, ,,
Geneva . .	713. 20 Geneva*	♂	12·8	—	4·0	5·0	7·2	—	9·2	4·6	4·8	,, ,,
,, . .	— Geneva	♂	13·0	—	3·8	5·0	7·2	—	9·4	4·6	5·0	,, ,,

Switzerland: Geneva . .	— Geneva	♀	13·2	7·8	3·8	5·0	7·2	4·8	9·4	4·6	4·8	Teeth moderately worn.
,, . .	1306 Mottaz		13·2	7·6	3.8	5·0	7·0	4·6	9·4	4·6	4·8	,, not worn.
,, . .	2199 Mottaz		13·0	8·0	4·2	5·0	7·4	4·8	9·4	4·6	5·0	,, ,,
Germany: Berlin . . .	66. 2. 1. 22	♂	13·0	8·6	4·0	5·0	7·2	4·8	9·6	4·6	5·0	,, ,,
Austria-Hungary: Palics, Bacser	0. 4. 7. 1	♀	13·2	8·6	4·0	5·0	7·2	5·0	9·6	4·6	5·0	,, slightly worn.
,, ,,	0. 4. 7. 2	♂	13·0	8·2	3·8	4·8	6·8	4·6	9·2	4·6	5·0	,, ,,
P. savii.												
Switzerland: St. Gothard, Uri	7. 1. 1. 397		13·4±	8·8	3·8	4·8	7·0	4·6	10·0	4·8	5·0	,, not worn.
Italy: Villa Doria, Liguria .	38027	♂	13·0	8·4	3·4	5·4	6·6	4·2	9·4	4·8	5·0	,, ,,
,, ,, .	5. 12. 15. 6		13·2	8·8	3·8	5·8	7·0	4·8	9·8	4·8	5·0	,, ,,
,, ,, .	Genoa	♂	13·6	9·0	3·6	5·6	7·0	4·6	10·0	4·8	5·2	,, slightly worn.
,, ,, .	,,	♂	14·0	8·8	3·4	5·8	7·2	4·8	10·0	4·8	5·0	,, ,,
,, ,, .	,,	♀	13·6	8·8	3·4	5·8	7·0	4·4	10·0	4·8	5·0	,, ,,
Florence . . .	2777 Mottaz	♂	13·8	8·6	3·6	5·8	6·8	4·6	10·0	4·8	5·2	,, ,,
Sicily: Palermo . . .	113905	♂	13·2	8·4	3·6	5·4	6·6	4·2	9·6	4·8	5·0	,, not worn.
,, . . .	103312	♂	13·0	8·6	3·4	5·4	6·6	4·6	9·6	4·8	5·0	,, ,,
,, . . .	103314	♂	12·8	—	3·4	5·2	6·8	4·6	9·4	4·6	5·0	,, slightly worn.
,, . . .	103312	♀	13·0	8·8	3·6	5·2	7·0	4·8	9·4	4·6	5·0	,, ,,
,, . . .	103321	♀	13·0	8·6	3·4	5·2	6·6	4·4	9·6	4·8	5·0	,, not worn.
,, . . .	103322	♀	13·6	9·0	3·6	5·2	7·0	4·4	10·0	4·8	5·2	,, slightly worn.
Spain: Escorial, Madrid . .	8. 7. 23. 1†	♂	13·6	8·8	3·6	5·6	6·8	4·4	9·8	4·8	5·2	,, ,,

* Type of *unicolor* Fatio.

† Paratype of *ochromixtus* Cabrera.

Adult male from Escorial, Spain (paratype of *ochromixtus* Cabrera): head and body, 48·6; tail, 34; tibia, 13·2; foot, 5·6; forearm, 57; thumb, 5·4; third finger, 43; ear from meatus, 13; width of ear, 11. For cranial measurements see Table, p. 223.

Specimens examined.—Twenty-four, from the following localities:—

Switzerland: St. Gothard, Uri, 1; no exact locality, 1.

Italy: Near Genoa, 10 (B.M. and Genoa); Florence, 3 (Mottaz); Sorrento, 1 (U.S.N.M.); no exact locality, 1 (type); Palermo, Sicily, 8 (U.S.N.M.); Sicily, no exact locality, 1 (type of *leucippe* Bonaparte); Ustica Island, Sicily, 1 (U.S.N.M.).

France: Near Nimes, Gard, 2 (U.S.N.M. and Nimes; the latter agreeing with description of *nigrans* Crespon, though not marked type); St. Gilles, Gard, 1; no exact locality, 1.

Spain: El Escorial, Madrid, 1 (paratype of *ochromixtus* Cabrera).

Remarks.—This species is readily distinguishable among the European members of the genus *Pipistrellus* by the peculiar form of the tragus, apart from its very pronounced cranial and dental characters. Its colour gives it a superficial resemblance to *Eptesicus nilssoni*, a likeness that is so heightened by the excessively small size of the anterior upper premolar that the animal has been once and perhaps twice described as a member of the genus *Eptesicus*.*

1.	St. Gothard, Uri, Switzerland.	Tomes Collection.	7. 1. 1. 397.
	Switzerland.	Purchased (Brandt).	45. 11. 1. 3.
4 al.	Genoa, Liguria, Italy.	Genoa Museum (E).	86. 11. 3. 14–17.
♂.	Borzoli, Liguria.	Marquis G. Doria (C & P).	5. 12. 15. 6.
skeleton without skull.	Italy. (*Prince Bonaparte.*)	Tomes Collection. (*Type* of species.)	7. 1. 1. 732.
skeleton without skull.	Italy. (*Prince Bonaparte.*)	Tomes Collection. (Type of *V. leucippe* Bonaparte.)	7. 1. 1. 731.
♀ al.	France.	Purchased (Lefebre).	46. 1. 2. 12.
♂.	El Escorial, Madrid, Spain.	A. Cabrera (P). (Paratype of *V. ochromixtus* Cabrera.)	8. 7. 23. 1.

Genus **EPTESICUS** Rafinesque.

1820. *Eptesicus* Rafinesque, Annals of Nature, p. 2 (*melanops* = *fuscus*).

1829. *Cnephæus* Kaup, Entw.-Gesch. u. Natürl Syst. Europ., Thierwelt, I, p. 103 (*serotinus*).

1839. *Vesperugo* Keyserling and Blasius, Wiegmann's Archiv für Naturgesch., 1839, I, p. 312 (part).

1839. *Vesperus* Keyserling and Blasius, Wiegmann's Archiv für Naturgesch., 1839, I, p. 313 (Sub-genus of *Vesperugo*, part). Not *Vesperus* Latreille, 1829.

* This is certainly the case with the *Vespertilio ochromixtus* of Cabrera. In the paratype of this species (B.M. no. 8. 7. 23. 1), which I carefully examined before removal of the skull, in company with Mr. Knud Andersen, no trace of the small premolar could be found. When the skull was cleaned, however, the presence of the tooth in its normal position was revealed, thus showing the animal's true identity. It seems not improbable, so far as can be judged from the original description, that Satunin's *Vesperugo caucasicus* (Zool. Anzeiger, XXIV, p. 462, August 5, 1901) was based on similar specimens.

1841. *Noctula* Bonaparte, Iconogr. Faun. Ital., I, fasc. XXI, in account of *Vespertilio alcythoe* (*serotinus*).

1856. *Cateorus* Kolenati, Allgem. deutsche Naturhist. Zeitung, Dresden, neue Folge, II, p. 131 (*serotinus*).

1856. *Meteorus* Kolenati, Allgem. deutsche Naturhist. Zeitung, Dresden, neue Folge, II, p. 131 (part).

1857. *Vesperus* Blasius, Säugethiere Deutschlands, p. 51 (Sub-genus of *Vesperugo*), part.

1858. *Amblyotus* Kolenati, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwissensch. Classe, XXIX, p. 252 (*atratus* = *nilssoni*).

1863. *Aristippe* "Kolenati, Beiträge zur Kenntniss der Phthiriomyiarien, Petersburg, 1863" (part, included both *discolor* = *murinus* and *nilssoni*).

1866. *Pachyomus* Gray, Ann. and Mag. Nat. Hist., 3rd ser., XVII, p. 90, February, 1863 (*pachyomus*).

1870. *Nyctiptenus* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LXII, p. 424 (*smithii*).

1878. *Vesperus* Dobson, Catal. Chiropt. Brit. Mus., p. 184 (Sub-genus of *Vesperugo*), part.

1892. *Adelonycteris* H. Allen, Proc. Acad. Nat. Sci. Philadelphia, 1891, p. 466, January 19, 1892 (part; substitute for *Vesperus*, preoccupied).

1897. *Vespertilio* Miller, Ann. and Mag. Nat. Hist., 6th ser., XX, p. 384, October, 1897 (part).

1900. *Eptesicus* Méhely, Monogr. Chiropt. Hungariæ, p. 219 (part).

1907. *Eptesicus* Miller, Families and Genera of Bats, p. 207, June 29, 1907.

Type species.—*Eptesicus melanops* Rafinesque = *Verpertilio fuscus* Beauvois.

Geographical distribution.—Europe, Asia (except Malay region), Australia, Africa, Madagascar; America from southern Canada southward (except Lesser Antilles).

Characters.—Dental formula: $i\ \frac{2}{3}\ \frac{2}{3}$, $c\ \frac{1}{1-1}\ \frac{1}{1-1}$, $pm\ \frac{1}{2-2}\ \frac{1}{2-2}$, $m\ \frac{3-3}{3-3}\ \frac{3-3}{3-3} = 32$. Teeth strictly normal throughout, and showing no special peculiarities. Both upper incisors well developed, the inner larger than the outer and usually with distinct secondary cusp, the outer separated from canine by a space equal to its greatest diameter; m^3 variable in form, usually with well developed metacone and three commissures in the smaller species, but with metacone and third commissure obsolete in larger forms. Skull without special peculiarities of form or structure, the rostrum flattish or more usually rounded off above, the nares and palatal emargination not specially enlarged, the latter at least as deep as wide. Ear of moderate size, not peculiar in form: wing broad (normal).

Remarks.—Among European bats the members of the genus *Eptesicus* may be distinguished by their dental formula combined with a simple *Pipistrellus*-like ear and not specially modified skull. The group is nearly related to *Pipistrellus* through *P. savii*, in which the small premolar is occasionally absent and not infrequently so minute as to be concealed by the gum. About forty-five species are known, three of which occur in Europe.

KEY TO THE EUROPEAN SPECIES OF *EPTESICUS*.

Forearm less than 40 mm.; condylobasal length of skull less than 16 mm.; a distinct line of demarcation between colours of upper and lower surfaces of neck ..... *E. nilssonii*, p. 234.

Forearm more than 45 mm.; condylobasal length of skull more than 17 mm.; no line of demarcation between colours of upper and lower surfaces of neck.

Condylobasal length of skull 19 to 21·6 mm. ..... *E. serotinus*, p. 226.

Condylobasal length of skull about 18 mm. ..... *E. sodalis*, p. 231.

EPTESICUS SEROTINUS Schreber.

1774. *Vespertilio serotinus* Schreber, Säugthiere, I, pl. LIII (Description, I, p. 167, 1775, under name: Die Blasse Fledermaus). France, based primarily on "La Sérotine" of Daubenton, Hist. Acad. Royale des Sci., 1759, p. 377. 1765.

1776. *Vespertilio serotine* P. L. S. Müller, Natursyst. Suppl. u. Regist.-Band, p. 16 (Based on "die Blasse Fledermaus" of Schreber).

1827. *Vespertilio wiedii* Brehm, Ornis, Heft III, p. 24 (Renthendorf, Thüringen, Germany).

1827. *Vespertilio okenii* Brehm, Ornis, Heft III, p. 25 (Renthendorf, Thüringen, Germany).

1844. *Vesp[ertilio] incisivus* Crespon, Faune Méridionale, I, p. 26 (Nîmes, Gard, France).

1857. *Vesperugo serotinus* Blasius, Säugethiere Deutschlands, p. 76.

1863. [*Cateorus serotinus*] var. *typus* Koch, Jahrb. des Vereins für Naturkunde im Herzogthum Nassau, XVIII, p. 466 (Wiesbaden, Nassau, Germany).

1863. [*Cateorus serotinus*] var. *rufescens* Koch, Jahrb. des Vereins für Naturkunde im Herzogthum Nassau, XVIII, p. 466 (Freiburg, Breisgau, Germany).

1878. *Vesperugo serotinus* Dobson, Catal. Chiropt. Brit. Mus., p. 191.

1885. *Vesperus serotinus* var. *transylvanus* Daday, Orvos-Termeszettudományi Értesető, Kolozsvar, X, p. 275 (Alsó-Szöcs, Szolnok-Doboka, Hungary).

1886. *Vesperus serotinus* var. *transsylvanus* Daday, Verhandl. u. Mittheilungen des Siebenbürgischen Vereins für Naturwissensch. in Hermannstadt, XXXVI, p. 81.

1900. *Eptesicus serotinus* Méhely, Monogr. Chiropt. Hungariæ, p. 209.

1904. *Vespertilio serotinus insularis* Cabrera, Mem. Soc. Españ. Hist. Nat., II, p. 263 (Minorca, Balearic Islands).

1904. *Vespertilio isabellinus* Cabrera, Mem. Soc. Españ. Hist. Nat., II, p. 264 (southern Spain). Not of Temminck.

1904. *Vespertilio boscai* Cabrera, Mem. Soc. Españ. Hist. Nat., II, p. 265 (Muchamiel, Alicante, Spain).

1910. *Eptesicus serotinus*, *E. serotinus transsylvanus*, and *E. boscai* Trouessart, Faune Mamm. d'Europe, pp. 20–22.

Type locality.—France.

Geographical distribution.—Central and southern Europe from England and Denmark to the Mediterranean; eastward into Asia.

Diagnosis.—Size rather large (forearm more than 45 mm.,

condylobasal length of skull more than 19 mm.) ; colour of upper parts a yellowish brown without noticeably contrasted light tips to the hairs ; under parts essentially similar, so that there is no line of demarcation along sides of neck.

External characters.—General form robust, though less so than in *Nyctalus*, the tail and legs rather short, the membranes thick and opaque. Muzzle with moderately prominent glandular swellings, its greatest width across this region less than distance from nostril to ear ; nostrils projecting very slightly, the concavity between them not conspicuous, the orifice crescentic. Ear moderately long, extending slightly more than half way from eye to nostril when laid forward, its breadth when flattened about equal to height above crown ; anterior border of conch abruptly convex below, then nearly straight to narrowly rounded off tip ; posterior border straight or irregularly concave from just below tip to level of anterior base, then convex to abrupt angle under meatus marking posterior limit of small but well defined antitragus, the anterior border of which terminates obscurely about 3 mm. behind angle of mouth ; inner surface of conch obscurely papillose, the region behind tragus marked by about six faint cross ridges ; tragus short, its height less than half that of ear conch, its anterior border straight, its posterior border gently convex from narrowly rounded tip to upper edge of small but distinct basal lobe, its greatest width, at level of middle of anterior border, equal to slightly more than half length of anterior border. Wing broad, the fifth finger exceeding forearm by one-quarter to one-third length of forearm, the membrane leathery and opaque, though perhaps less so than in *Nyctalus noctula*, joining leg at base of outer toe ; third and fourth metacarpals sub-equal, nearly as long as forearm, fifth about 2 mm. shorter. Leg rather slender, the foot less than half as long as tibia ; calcar about four-fifths as long as tibia and slightly exceeding length of free border of uropatagium, its keel ill-defined, its terminal lobe well developed though small. Tail extending to between shoulders when laid forward, the last vertebra and distal third of penultimate vertebra free from membrane.

Fur and colour.—Fur soft and dense, the longest hairs on back about 10 mm. in length, those of underparts shorter. It is strictly confined to body, only extending as a thin pubescence on extreme base of membranes and along a narrow line bordering under surface of forearm ; free edge of uropatagium naked. Ground colour of upper parts ranging from prouts-brown to a light wood-brown, the basal portion of the hairs not essentially different, the tips of the hairs of back behind shoulders with inconspicuous lighter (buffy) tips ; underparts slightly paler, sometimes approaching ochraceous-buff, but never sufficiently contrasted to produce a line of demarcation along sides of neck. Muzzle, cheeks, ears and membranes blackish. The variation in general colour appears to be strictly individual.

Skull.—General aspect of skull robust and flattened, with widely spreading zygomata, but rather narrow brain-case and rostrum. Dorsal profile rising gradually from nares to overhanging lambda, essentially straight throughout, though with slight concavity over lachrymal region. Ventral profile very slightly elevated posteriorly. Brain-case ovate in general outline, narrower than in *Nyctalus noctula*, the straight, well developed lambdoid crests which form its posterior border meeting in median line almost at right angles, depth at middle about half mastoid breadth; sagittal crest low but evident, the region at each side of it not depressed; floor of brain-case smooth, with no evident ridges or depressions, a very narrow slit between cochlea and basioccipital; auditory bullæ small, the transverse diameter considerably less than distance between bullæ. Interorbital region moderately constricted, hour-glass shaped, the lachrymal region decidedly less wide than brain-case, with slight tubercular projection close to anterior rim of orbit; rostrum flattened, with shallow but evident lateral concavity on each side, distinctly narrower anteriorly than posteriorly, the narrowly obovate narial emargination extending about half way back to level of lachrymal foramen; rostral depth at front of orbit less than distance from orbit to outer incisor; anteorbital foramen less reduced than in *Nyctalus noctula*, its posterior border over region of contact between large premolar and first molar, lachrymal foramen directly behind it, on inner side of orbital rim. Palate long and narrow, slightly concave both laterally and longitudinally, the anterior emargination small, squarish, extending back to level of middle of canine. Posterior extension of palate nearly parallel sided, though narrowing a little posteriorly, its width at level of posterior molar considerably less than its length; hamulars slightly turned inward; median spine well developed. Mandible robust, but with lower border nearly parallel to alveolar line; posterior portion high in front, low behind, the height of coronoid process above level of alveolar line about equal to horizontal diameter, the upper border sloping abruptly from coronoid to articular process; angular process moderately long, about on level with alveolar line, its main axis directed gradually outward and downward, its distal extremity slightly expanded and hooked upward.

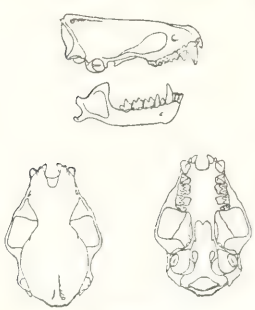

FIG. 40.
Eptesicus serotinus. Nat. size.

Teeth.—Relatively to size of skull the teeth are large and robust, rather more so than in *Nyctalus noctula*. Inner upper incisor about half as high as canine, its crown area about one-

quarter that of canine, the subterete shaft directed inward and slightly forward, its secondary cusp large and prominent, situated on outer side of shaft near tip; cingulum well developed, but without cusps. Outer upper incisor much shorter than inner and with about half its crown area, the apex of its shaft slightly exceeding level of cingulum of larger tooth; outer and posterior surfaces flattened or double-concave, the two concavities sometimes separated by a low but evident ridge; inner margin with a low secondary cusp on well developed cingulum. A line perpendicular to main axis of skull would pass through centre of shafts of all four incisors; the outer tooth is separated from canine by a space about equal to breadth of its own crown. Lower incisors large, much crowded, and very conspicuously imbricated, i_1 and i_2 overlapping more than half of front surface of the succeeding tooth, the general outline of the entire series V-shaped; front surface of crowns about as high as wide, the edge obliquely trifid (occasionally a low, rudimentary fourth cusp at outer margin of i_2); cross section of crown somewhat triangular, the posterior angle occupied by a low tubercle in i_2 and i_3. Upper canine large, its shaft decidedly the highest of the upper series, its cross section sub-triangular, the posterior cutting edge well developed, the anterior less trenchant than in *Nyctalus noctula*; inner surface divided by a low ridge into two shallow concavities, the posterior of which is the larger; antero-outer surface convex; postero-outer surface with deep longitudinal groove; cingulum narrow but complete, without cusps. Lower canine very robust, the diameter of crown noticeably greater than least distance between canines, the shaft decidedly higher than main cusps of molars, smoothly rounded in front, flattened-concave behind and on inner side, the cingulum narrow but complete except at point of contact with i_3, where it becomes abruptly obsolete, terminating in a slight tubercle corresponding to the cusp present in *Nyctalus* and *Pipistrellus*. Upper premolar with crown area about equal to that of canine and about two-thirds that of first molar, its main cusp robust, nearly as long as canine (measured along cingulum), sharply trenchant posteriorly, flattened-concave on inner side, a well developed external and antero-internal longitudinal groove; crown with slight anterior and more marked posterior emargination, the inner side narrow, with slight concave crushing surface and well developed cingulum, which rises to a small cusp anteriorly. Lower premolars closely crowded, the crown area of first about half that of canine, that of second nearly four-fifths that of canine; cusp of first a little more than half as high as second, which slightly exceeds main cusps of molars; cingulum of each tooth well developed, tending to form a slight postero-internal tubercle. First and second upper molars sub-equal in crown area, the second wider but more constricted at middle; protocone robust, not very high; no true hypocone, but region which it would occupy indicated by slight

columnar thickening of posterior base of protocone ; paracone lower and smaller than metacone, the contrast unusually noticeable ; styles and commissures well developed, the W-pattern normal ; m^3 with crown area less than half that of m^1, its longitudinal diameter through metacone much less than half transverse diameter, the mesostyle, metacone, and second and third commissures greatly reduced, though not sufficiently to lose their identity. Lower molars with no special peculiarities ; angles in commissures between outer and inner cusps rather wide and shallow, especially that between protoconid and metaconid : area of second V in m_3 scarcely half that of first.

Measurements.—Adult female from Herrnhut, Saxony : head and body, 62 ; tail, 54 (its free tip, 6·6) ; tibia, 20 ; foot, 10·4 ; **forearm**, 50·4 ; thumb, 9 ; third finger, 84 : fifth finger, 63 ; ear from meatus, 18 ; width of ear, 15. Adult male from Barsac, Gironde, France : head and body, 69 ; tail, 54 (free tip, 7·6) ; tibia, 22 ; foot, 11·4 ; **forearm**, 51 : thumb, 9 ; third finger, 91 ; fifth finger, 67 ; ear from meatus, 18·4 ; width of ear, 16. Adult male and female from Seville, Spain : head and body, 67 and 64 ; tail, 46 and 51 ; tibia, 21·6 and 22·4 ; foot, 11 and 10·4 ; **forearm**, 49 and 50 ; thumb, 9·2 and 8·4 ; third finger, 89 and 90 ; fifth finger, 64 and 68 ; ear from meatus, 17·6 and 18. Adult male and female from Rome, Italy : head and body, 72 and 73 ; tail, 54 and 54 ; tibia, 21·4 and 21 ; foot, 11 and 11·4 ; **forearm**, 51·6 and 53 ; thumb, 9·6 and 9·8 ; third finger, 91 and 92 ; fifth finger, 66 and 67 ; ear from meatus, 19 and 19 ; width of ear, 15·6 and 15·4. For cranial measurements see Table, p. 232.

Specimens examined.—Seventy-eight, from the following localities :—

England : Kenley, Surrey, 1 ; Hawkhurst, Kent, 1 ; Whitstable, Kent, 2 ; Wingham, Dover, Kent, 1 ; Yalding, Kent, 5 (B.M. and U.S.N.M.) ; Isle of Wight, 5.

France : Barsac, Gironde, 1 (U.S.N.M.) ; near Nîmes, Gard, 2 (Nîmes ; type of *incisivus* Crespon, and a specimen wrongly marked type of *palustris* Crespon).

Germany : Ingelheim, Rheinhessen, 2 ; Magdeburg, Saxony, 2 (B.M. and U.S.N.M.) ; Herrnhut, Saxony, 1 (U.S.N.M.) ; Strass, near Burgheim, Bavaria, 3 ; Bavaria, no exact locality, 2 (U.S.N.M.) ; Tübingen, Silesia, 2.

Austria-Hungary : Moravia, 1 ; Csallóköz-Somorja, Pressburg, Hungary, 1 ; Budapest, Hungary, 2 ; Transylvania, 5 ; Zara, Dalmatia, 2.

Roumania : Bustenari, Prahova, 3.

Greece : Patras, 14 ; near Athens, 1.

Italy : Siena, 3 (B.M. and U.S.N.M.) ; Florence, 2 (B.M. and U.S.N.M.) ; Vallombrosa, 1 (U.S.N.M.) ; Volterra, 1 (U.S.N.M.) ; Rome, 3 ; San Martino al Cimino, Rome, 1 (Genoa) ; Ustica Island, Sicily, 1 (U.S.N.M.).

Sardinia : Cagliari, 2 (Genoa).

Spain : Pajáres, Leon, 1 ; Seville, 3 ; Muchamiel, Alicante, 1 (Madrid ; type of *boscai* Cabrera).

Remarks.—Among the bats of Europe this species is recognizable by its rather large size, noticeable free tip to the tail, moderately long, narrow ear, and straight, erect tragus. With the material now available for study it seems impossible to

distinguish any local geographical forms. Specimens from Seville representing the *isabellinus* of Cabrera I am unable to separate from true *serotinus*; the type of *boscai* Cabrera is a young of the same animal; *insularis* I have not seen, but there is nothing in the original description to indicate that it is distinct.*

♂.	Kenley, Surrey, England.	W. R. Ogilvie-Grant (C & P).	11. 1. 3. 45.
2 ♀.	Whitstable, Kent.	C. H. B. Grant (C & P).	11. 1. 3. 46–47.
♀ al.	Wingham, Kent.	G. Donker (C & P).	90. 4. 17. 1.
1 st.	Yalding, Kent.	H. Reid (C & P).	97. 8. 27. 1.
3 ♀.	Yalding, Kent.	W. R. Ogilvie-Grant (C & P).	11. 1. 3. 42–44.
♀ al.	Isle of Wight.	Rev. C. Bury (C & P).	44. 6. 15. 7.
2.	Freshwater, Isle of Wight.	F. Bond (C & P).	61. 11. 5. 1–2.
1.	Freshwater, Isle of Wight. (*F. Bond.*)	Tomes Collection.	7. 1. 1. 352.
1.	Bembridge, Isle of Wight.	Tomes Collection.	7. 1. 1. 353.
♂, ♀.	Ingelheim, Rheinhessen, Germany.	C. Hilgert (C).	8. 11. 2. 1–2.
1.	Magdeburg, Saxony. (*Wolterstorff.*)	Lord Lilford (P).	11. 1. 1. 38.
2 ♂, ♀.	Strass, Burgheim, Bavaria. (*Körbitz.*)	Lord Lilford (P).	11. 1. 1. 33–35.
2 al.	Tübingen, Silesia.	Dr. A. Günther (P).	66. 2. 1. 7–8.
1 al.	Moravia, Hungary.	Purchased (Parreys).	46. 6. 15. 54.
2.	Csallóköz-Somorja, Pressburg.	Budapest Museum (E).	94. 3. 1. 12–13.
2 al.	Budapest.	Budapest Museum (E).	94. 7. 18. 6–7.
5 ♂ al.	Transylvania.	C. G. Danford and J. A. Brown (C & P).	74. 7. 4. 1–5.
♂, ♀.	Zara, Dalmatia. (*K. Blos.*)	Lord Lilford (P).	11. 1. 1. 36–37.
♂, ♀.	Bustenari, Prahova, 840 m. Roumania. (*W. Dodson.*)	Lord Lilford (P).	4. 4. 6. 2–3.
1 ♀.	Patras, Greece. (*C. Mottaz.*)	Hon. N. C. Rothschild (P).	8. 10. 2. 1–13, 15.
♀.	Patras.	C. Mottaz (C).	8. 11. 3. 3.
♀.	Athens. (*C. Mottaz.*)	Hon. N. C. Rothschild (P).	8. 10. 2. 14.
1 al.	Florence, Italy.	Florence Museum (E).	85. 7. 6. 13.
♂.	Rome. (*C. Coli.*)	G. Barrett-Hamilton (P).	11. 1. 2. 28.
♀.	Pajáres, Leon, Spain. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 1.
♀ al.	Seville.	Dr. V. L. Seoane (P).	94. 1. 1. 6.
1 al.	Seville.	Seville Museum (E).	94. 5. 8. 1.
1.	Europe.	Leyden Museum (E).	37. 4. 28. 58.

EPTESICUS SODALIS Barrett-Hamilton.

1910. *Vespertilio sodalis* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 8th ser., v, p. 291, March, 1910. Type in British Museum.

1910. *Eptesicus sodalis* Trouessart, Faune Mamm. d'Europe, p. 22.

Type locality. Bustenari, Prahova, Roumania (in Carpathians, alt. 840 m.).

Geographical distribution.— Known only from the type locality and St. Gothard, Switzerland.

* Mr. Cabrera has come to the same conclusion (Bol. Real Soc. Españ. Hist. Nat., VI, p. 449, December, 1908).

CRANIAL MEASUREMENTS OF *EPTESICUS SEROTINUS* AND *E. SODALIS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case at middle.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
E. serotinus.												
England: Yalding, Kent. .	152590	♀	19·8	14·6	4·6	8·2	9·8	6·0	15·4	7·8	8·4	Teeth slightly worn.
France: Barsac, Gironde .	86926	♂	19·8	14·0	4·4	8·2	9·8	6·0	15·2	7·6	8·4	,, moderately worn.
Germany: Magdeburg . .	152588	♀	19·4	14·4	4·2	8·4	9·8	5·6	15·2	7·6	8·4	,, slightly worn.
Strass, near Burgheim . .	11. 1. 1. 33	♂	20·0	14·0	4·4	8·4	9·4	6·0	15·8	8·0	9·0	,, ,,
Roumania: Bustenari . .	4. 4. 6. 3	♀	20·8	14·6	4·6	8·6	9·8	6·0	16·0	7·8	9·0	,, much worn.
Greece: Patras . . .	8. 10. 2. 1	♀	21·0	14·8	4·2	8·4	10·0	6·0	16·2	8·0	8·6	,, ,,
,, . . .	152575	♀	20·4	14·6	4·2	8·8	9·8	6·2	16·0	7·8	8·8	,, slightly worn.
,, . . .	8. 10. 2. 2	♀	20·6	15·0	4·6	8·4	10·0	6·0	16·0	8·0	8·6	,, much worn.
,, . . .	152576	♀	20·6	14·8	4·6	8·8	10·0	6·2	16·0	8·2	9·0	,, slightly worn.
,, . . .	152577	♀	20·4	14·4	4·2	8·4	9·8	6·0	15·8	8·0	8·8	,, ,,
,, . . .	8. 10. 2. 3	♀	20·4	14·8	4·8	8·8	10·0	6·4	16·0	8·2	9·0	,, ,,
,, . . .	8. 10. 2. 4	♀	20·2	14·2	4·6	8·6	9·8	6·0	15·6	8·0	9·0	,, ,,

Greece: Patras	152579	♀	20·4	14·8	4·6	8·6	10·0	6·2	15·8	8·0	8·8	Teeth slightly worn.
,,	152580	♀	21·2	14·6	4·8	8·6	10·0	6·0	16·0	8·2	9·0	,, moderately worn.
,,	8. 10. 2. 10	♀	20·0	14·6	4·4	8·6	9·8	6·0	15·4	7·8	8·8	,, much worn.
Italy: Siena	152589	♂	20·6	15·4	4·8	8·8	10·0	6·0	15·8	8·0	9·0	,, ,,
,,	86593	♀	19·6	14·4	4·4	8·4	9·8	6 2	15·0	7·4	8·4	,, slightly worn.
Florence	37393		20·4	14·4	4·6	8.6	10·0	6·4	16·0	8·0	8·8	,, ,,
Vallombrosa	114675	♂	19·2	14·0	4·2	8·0	9·6	6·0	14·8	7·6	8·2	,, ,,
Rome	113871	♂	19·2	14·2	4·4	7·8	9·8	6·0	15·0	7·6	8·4	,, not worn.
,,	113873	♂	19·8	—	4·2	7·8	—	—	15·4	7·8	8·6	,, ,,
Ustica Island, north of Sicily	113892	♂	19·0	14·0	4·2	8·0	9·8	5·8	15·0	7·6	8·6	,, slightly worn.
Sardinia: Cagliari	Genoa Z.	♂	20·2	—	4·4	8·6	9·8	6·0	15·6	8·2	9·0	,, not worn.
,,	Genoa K.	♀	21·6	15·4	4·2	8·6	9·8	6·2	16·0	8·2	9·0	,, much worn.
Spain: Pajáres, Leon	8. 2. 9. 1	♀	20·0	14·6	4·6	8·6	9·4	6·0	15·8	8·0	8·8	,, slightly worn.
Seville	94. 1. 1. 6	♀	20±	14·4	4·6	8·6	10·0	—	15·8	8·0	8·8	,, not worn.
Muchamiel, Alicante	1234* Madrid	♀ juv.	18·2	12·8	4·6	7·2	9·2	5·6	14·0	7·2	8·2	Basilar suture open.
E. sodalis.												
Roumania: Bustenari	4. 4. 6. 1†	♂	18·0	13·2	4·6	6·6	9·4	6·2	14·2	7·2	8·0	Teeth not worn.
Switzerland: St. Gothard, Uri	37295		18±	12·8	4·0	7·0	9·2	—	14·4	7·2	8·2	,, moderately worn.

* Type of *boscai* Cabrera.

† Type.

Diagnosis.—Similar to *Eptesicus serotinus* but smaller, condylobasal length of skull about 18 mm. instead of 19 to 21·6 mm.

Measurements.—Type (young-adult male): head and body, 63; tail, 42; tibia, 18·6; foot, 9·8; **forearm**, 45·4; third finger, 79·0; fifth finger, 58·0; ear (fresh), 18. Adult from St. Gothard, Switzerland: tibia, 19; **forearm**, 48. For cranial measurements see Table, p. 233.

Specimens examined.—Two, from the following localities:—
Switzerland: St. Gothard, 1 (U.S.N.M.).
Roumania: Bustenari, Prahova, 1 (type).

Remarks.—The two specimens on which this species is based indicate the existence of an animal bearing much the same relationship to *Eptesicus serotinus* as *Nyctalus noctula* to *N. maximus*.

♂.	Bustenari, Prahova, 840 m. Roumania. (*W. Dodson.*)	Lord Lilford (P). (*Type* of species.)	4. 4. 6. 1.

EPTESICUS NILSSONII Keyserling and Blasius.

1836. *Vespertilio kuhlii* Nilsson, Illum. Fig. Skand. Fauna, pt. 17, pl. 34 upper figure. Not of Kuhl, 1819.
1838. *Vespert[ilio] borealis* Nilsson, Illum. Fig. Skand. Fauna, pt. 19, pl. 34 (renumbered 36) upper figure. Not of P. L. S. Müller, 1776 (Scandinavia).
1839. *V[espertilio] nilssonii* Keyserling and Blasius, Wiegmann's Archiv für Naturgesch., 1839, p. 315 (Mountains of Scandinavia. Based on the *V. kuhlii* of Nilsson, 1836).
1857. *Vesperugo nilssonii* Blasius, Säugethiere Deutschlands, p. 70.
1858. *Amblyotus atratus* Kolenati, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwissensch. Classe, xxix, p. 252 (Altvater, Austrian Silesia, alt. 2400–4600 ft.).
1878. *Vesperugo borealis* Dobson, Catal. Chiropt. Brit. Mus., p. 203.
1894. *Vesperugo nillsoni* (sic) Rhoads, Reprint Ord's N. Amer. Zoology, Append., p. 3.
1907. *E[ptesicus] nilssoni* Miller, Families and Genera of Bats, p. 209, June 29, 1907.
1910. *Eptesicus nilssoni* Trouessart, Faune Mamm. d'Europe, p. 23.

Type locality.—Sweden.

Geographical distribution.—Continental Europe, from northern Norway to the Alps.

Diagnosis.—Size medium (forearm less than 40 mm., condylobasal length of skull less than 16 mm.); colour of upper parts a rich dark brown, the hairs of back with noticeably contrasted light tips; underparts light yellowish brown; a well defined line of demarcation along sides of neck.

External form.—In general the external form agrees with that of *Eptesicus serotinus*, due allowance being made for the less robust stature of the smaller animal. Ear relatively longer,

extending to nostril when laid forward, though of the same general form as in *E. serotinus;* tip less narrowly rounded off, and flattened or concave portion of posterior border less conspicuous; tragus relatively shorter and wider, though not essentially different in form, its greatest width nearly equal to length of anterior border; transverse striations on inner surface of conch obsolete. Wings and feet essentially as in *E. serotinus*. Tail slightly longer than in the related animal, extending nearly to head when laid forward, its terminal vertebra free.

Fur and colour.—In quality the fur resembles that of *E. serotinus* except that it is softer and more silky in texture, the hairs fully as long as in the larger animal. In distribution it shows no special peculiarities; dorsal surface of uropatagium thinly furred to about middle instead of on extreme base only. Colour above a rich dark brown, ranging from burnt-umber nearly to seal-brown, the hairs everywhere with slightly darker, faintly slaty bases, those of median dorsal region from crown to base of tail tipped with light glossy ochraceous-buff in evident contrast with ground colour, the light tips most numerous behind shoulders, and forming a noticeable mantle over middle of back; underparts rather strongly contrasted light yellowish brown, between the wood-brown and ochraceous-buff of Ridgway, the basal portion of the hairs similar to ground colour of back, the yellowish brown area extending over sides of head and completely encircling base of ear, the line of demarcation between it and the dark brown of upper parts sharply defined along sides of neck. Muzzle, cheeks, ears and membranes blackish.

Skull.—In general the skull differs from that of *Eptesicus serotinus*, apart from its smaller size, in a general tendency to greater depth, less elongation, and smoother, more evenly rounded surfaces. Dorsal profile with evident convexity at middle. Lambda not overhanging; low, ill-defined lambdoid crests curving slightly toward point of contact at middle, the rounded posterior outline of the occiput plainly visible behind them when skull is viewed from above; sagittal crest essentially absent. Brain-case sub-spherical or broadly ovate in outline, its depth slightly more than half mastoid breadth; floor of brain-case marked by a wide lateral groove between each cochlea and the median line; auditory bullæ slightly larger than in *E. serotinus*. Interorbital region relatively less constricted than in *E. serotinus*, but of essentially the same form; lachrymal swelling present but less noticeable than in the larger animal. Rostrum rounded off at sides, with only the faintest trace of lateral concavities; narial and palatal emarginations essentially as in *E. serotinus*. Palate showing no

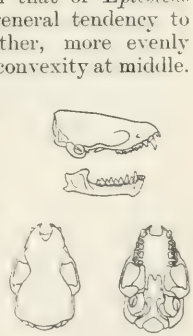

FIG. 41.

Eptesicus nilssonii. Nat. size.

noteworthy peculiarities, its general outline less narrow than in the related species.

Teeth.—Inner upper incisor as in *Eptesicus serotinus*, but more robust in proportion to its height; outer incisor noticeably higher than in the related species, its apex reaching level of secondary cusp of larger tooth, its secondary cusp more prominent; no marked contrast between crown areas of the two teeth; each pair in line of general curve of anterior portion of palate, instead of at right angles to main axis. Lower incisors less crowded than those of *E. serotinus*, their imbrication distinct but not unusual, the general outline of the row broadly V-shaped; in form the individual teeth show no special peculiarities; i_2 without postero-internal tubercle. Canines and premolars with no special peculiarities. First and second upper molars essentially as in *Eptesicus serotinus*, but disproportion between paracone and metacone less evident; m^3 with crown area about two-thirds that of m^1, its longitudinal diameter through metacone slightly more than half transverse diameter, the mesostyle and metacone well developed, the second and third commissures more than half as long as first; lower molars like those of *E. serotinus* in form, but angles in commissures between outer and inner cusps deeper; area of second V in m_3 nearly equal to that of first.

Measurements.—Adult male from Grotte de Vallorbe, Vaud, Switzerland: head and body, 68·5; tail, 47; tibia, 17; foot, 10; **forearm**, 38·2; thumb, 9·8; third finger, 68; fifth finger, 49. **Forearm** in adult male from Upsala, Sweden, 38·4. Three females from the same locality: **forearm**, 39, 39, and 39·6; third finger in the four specimens from Upsala: 66, 68, 70 and 68. For cranial measurements see Table opposite.

Specimens examined.—Fifteen, from the following localities:—
NORWAY: No exact locality, 1.
SWEDEN: Upsala, 8 (B.M. and U.S.N.M.); Upland, 2 (U.S.N.M.).
GERMANY: Wernigerode, Saxony, 2.
AUSTRIA-HUNGARY: Csallóköz-Somorja, Pressburg, 1.
SWITZERLAND: Grotte de Vallorbe, Vaud, 1 (Mottaz).

Remarks. This species is readily distinguishable from *Eptesicus serotinus* by its smaller size and by the conspicuous pale tips to the hairs of back. From *Vespertilio murinus*, which resembles it in colour pattern, the narrow ear, more yellowish (less whitish) hair-tips on back, and slightly smaller size distinguish it superficially. *Pipistrellus savii*, which often has almost exactly similar coloration, is a much smaller animal (forearm, 31 to 33 instead of 38 to 40).

1.	Norway. (*Colletl.*)	E. R. Alston (P.)	81. 6. 9. 2.
4 ♀.	Upsala, Sweden. (*Kolthoff.*)	Lord Lilford (P).	11. 1. 1. 39–42.
♂, ♀.	Wernigerode, Saxony, Germany.	Dr. W. Wolterstorff (C & P).	0. 2. 8. 3–4.
1.	Csallóköz-Somorja, Pressburg, Hungary.	Budapest Museum (E.)	94. 3. 1. 14.

CRANIAL MEASUREMENTS OF *EPTESICUS NILSSONII*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case at middle.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
Sweden: Upland . . .	22395	♀	14·8	10·0	4·2	6·0	7·8	5·2	10·8	5·4	6·0	Teeth slightly worn.
,, . . .	22396	♀	14·8	10·0	4·0	6·0	8·0	5·2	11·0	5·2	5·8	,, ,,
Upsala . . .	152591	♂	14·2	9·0	4·0	5·8	7·6	4·6	10·6	5·0	5·4	,, not worn.
,, . . .	11. 1. 1. 39	♀	14·6	10·0	4·0	6·2	8·0	4·8	10·8	5·2	5·6	,, slightly worn.
,, . . .	11. 1. 1. 41	♀	14·2	9·6	4·2	6·0	7·8	5·0	11·0	5·2	5·8	,, not worn.
,, . . .	152592	♀	14·8	10·0	4·2	6·0	7·8	4·8	11·2	5·4	6·0	,, ,,
,, . . .	11. 1. 1. 40	♀	14·6	9·8	4·0	5·8	7·8	5·0	11·0	5·4	6·0	,, moderately worn.
,, . . .	11. 1. 1. 42	♀	15·0	10·0	4·2	6·0	8·0	5·0	10·6	5·2	5·8	,, not worn.
,, . . .	152593	♀	14·0	10·0	4·2	6·2	8·0	5·0	10·8	5·2	5·8	,, slightly worn.
Germany: Wernigerode, Saxony . .	0. 2. 8. 3.	♂	14·8	10·4	4·2	6·4	8·2	5·0	11·0	5·4	6·0	,, ,,
,, ,,	0. 2. 8. 4	♀	15·2	10·2	4·0	6·8	8·0	5·0	11·6	5·8	6·2	,, ,,
Switzerland: Grotte de Vallorbe, Vaud . .	1378 Mottaz	♂	15·4	10·4	4·4	6·2	8·0	4·8	11·4	5·4	6·0	,, ,,

Genus **VESPERTILIO** Linnæus.

1758. *Vespertilio* Linnæus, Syst. Nat., I, 10th ed., p. 31 (*murinus* by tautonymy).
1839. *Vesperugo* Keyserling and Blasius, Wiegmann's Archiv für Naturgesch., 1839, I, p. 312 (part).
1839. *Vesperus* Keyserling and Blasius, Wiegmann's Archiv für Naturgesch., 1839, I, p. 313. Sub-genus of *Vesperugo* (part).
1856. *Meteorus* Kolenati, Allgem. deutsche Naturhist. Zeitung, Dresden, neue Folge, II, p. 131 (part).
1857. *Vesperus*, misprinted *Vesperugo* Blasius, Säugethiere Deutschlands, p. 69 (Sub-genus of *Vesperugo*).
1863. "*Aristippe* Kolenati, Beiträge zur Kenntniss der Phthiriomyiarien, Petersburg, 1863" (part).
1872. *Marsipolæmus* Peters, Monatsber. k. preuss. Akad. Wissensch., Berlin, p. 260 (Sub-genus of *Vesperugo* for *albigularis* = *murinus*).
1878. *Vesperus* Dobson, Catal. Chiropt. Brit. Mus., p. 183. Sub-genus of *Vesperugo* (part).
1897. *Vespertilio* Miller, Ann. and Mag. Nat. Hist., 6th ser., XX, p. 384, October, 1897 (part).
1900. *Vespertilio* Méhely, Monogr. Chiropt. Hungariæ, p. 219 (part).
1907. *Vespertilio* Miller, Families and Genera of Bats, p. 209, June 29, 1907.

Type species.—*Vespertilio murinus* Linnæus.

Geographical distribution.—Forested northern portion of the Palæarctic region from the Atlantic coast eastward through Continental Asia.

Characters.—Like *Eptesicus*, but ear much shortened and broadened, rostrum flattened above, with deep concavity on each side between nares and lachrymal region; nares very large, extending back nearly half way to interorbital constriction, and palatal emargination extended so far laterally that its width is distinctly greater than its depth.

Remarks.—The genus *Vespertilio* as now restricted contains only two species, *V. murinus* Linnæus, and *V. superans* Thomas, the former European, the latter Asiatic. The form of the skull suggests in certain respects that of *Nyctalus*, and in others the North American *Lasionycteris*.

VESPERTILIO MURINUS Linnæus.

1758. [*Vespertilio*] *murinus* Linnæus, Syst. Nat., I, 10th ed., p. 32 (Sweden).
1819. *Vespertilio discolor* Kuhl, Ann. Wetterau. Gesellsch. Naturk., IV (= Neue Ann., I), pt. 2, p. 187 (Vienna, Austria).
1857. *Vesperugo discolor* Blasius, Säugethiere Deutschlands, p. 73.
1872. *Vesperus* (*Marsipolæmus*) *albigularis* Peters, Monatsber. k. preuss. Akad. Wissensch., Berlin, p. 260 (Type supposed to have been taken in Mexico; for its reference to this species see Méhely, Monogr. Chiropt. Hungariæ, pp. 229, 341, 1900).
1878. *Vesperugo discolor* Dobson, Catal. Chiropt. Brit. Mus., p. 204.
1885. *Vesperus siculus* Daday, Orvos-Termeszettudományi Értesetö, Kolozsvar, X, p. 275 (Homorod-Almas cave, Hungary). See Méhely, Monogr. Chiropt. Hungariæ, pp. 229, 346, 1900.

1886. *Vesperus siculus* Daday, Verhandl. u. Mittheilungen des Siebenbürgischen Vereins für Naturwissensch. in Hermannstadt, xxxvi, p. 82.
1897. *Vespertilio murinus* Miller, Ann. and Mag. Nat. Hist., 6th ser., xx, p. 382, October, 1897.
1910. *Eptesicus siculus* and *Vespertilio murinus* Trouessart, Faune Mamm. d'Europe, pp. 23 and 25.

Type locality.—Upsala, Sweden.

Geographical distribution.—Northern and central Europe, from southern Norway and central Sweden south to the Alps. One record of its occurrence in England.*

Diagnosis.—General characters as in the genus; length of forearm about 43 to 45 mm.

External characters.—General appearance much as in *Eptesicus nilssonii* but slightly larger and more robust. Ear extending nearly to nostril when laid forward, its width when flattened about 1½ times height from crown; anterior basal lobe so much reduced as to suggest the keel of the *Molossidæ*, the anterior border of conch nearly straight from forehead to broadly rounded tip; posterior border shallowly sinuous-concave from just below tip nearly to level of meatus; here it turns forward almost at right angles and extends nearly to angle of mouth, where it terminates at a well developed wart, the terminal portion often forming a slight fold or pocket; antitragus low and keel-like, nearly 2 mm. from margin of conch; inner surface of conch slightly papillose, without evident cross ridges; tragus low, scarcely rising above level of outer angle of anterior lobe, its greatest width (slightly above middle) nearly equal to length of straight or slightly concave anterior border, its tip broadly rounded, the convexity continuous behind with that of upper portion of posterior border; posterior basal lobe obsolete. Wing rather narrow, the fifth finger exceeding forearm by one-sixth to one-fifth length of forearm, the membranes thin, extending to base of outer toe; third and fourth metacarpals sub-equal, nearly 5 mm. shorter than forearm, fifth about 3 mm. shorter than third. Leg rather robust; foot about half as long as tibia; calcar slightly longer than tibia and free border of uropatagium, its keel ill defined, its termination obscure. Tail extending to between shoulders when laid forward, the last vertebra free.

Fur and colour.—The fur is rather short and dense, less silky than that of *Eptesicus nilssonii*, the hairs at middle of back about 7 mm. in length. In distribution it shows no special peculiarities; upper surface of interfemoral membrane furred on basal third. Colour above essentially as in *Eptesicus nilssonii*, but light tips to hairs very pale, almost whitish cream-buff, producing a decidedly "frosted" appearance; underparts cream-buff, the dusky under colour showing through on chest and anterior portion of belly; line of demarcation on sides of neck sharply defined; muzzle and chin dusky; ears and membranes blackish.

* A single specimen, undoubtedly a straggler, taken at Plymouth.

Skull.—The skull combines the short, smooth brain-case of *Eptesicus nilssonii* with the broad, flat rostrum of *E. serotinus*, but differs conspicuously in aspect from both in the very deep, *Nyctalus*-like narial and palatal emarginations. Dorsal profile essentially straight from nares to rounded, not overhanging lambda. Sagittal crest obsolete; lambdoid crest low but evident. Depth of brain-case at middle decidedly more than half mastoid breadth; floor with wide conspicuous slit between cochlea and basioccipital; a flattened pit-like depression at front of each slit; auditory bullæ moderately large, their transverse diameter about equal to space between them. Interorbital region broadly hour-glass shaped, flattened above; edge of orbit from lachrymal region nearly to most constricted portion distinctly and irregularly swollen. Dorsal surface of rostrum flattened, with broad, shallow lateral depressions; narial emargination broadly triangular, its apex extending back to level of lachrymal region; rostral depth at front of orbit equal to distance from orbit to front of inner incisor; anteorbital foramen moderately large, over point of contact between large premolar and first molar; lachrymal foramen directly behind it on inner rim of orbit. Palate broad and short, noticeably concave both laterally and longitudinally, the anterior emargination large, much wider than deep, but extending back to level of middle of premolar; posterior extension of palate parallel sided, its length slightly greater than width behind molars; hamulars slightly bent inward; median spine well developed. Mandible robust, much deeper at symphysis than behind tooth-row, the coronoid process low (height less than least width of posterior section) with gradually sloping upper border; angular process rather slender, its extremity slightly curved inward.

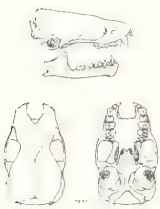

FIG. 42.
Vespertilio murinus.
Nat. size.

Teeth.—While in general resembling those of the European species of *Eptesicus*, especially those of *E. nilssonii*, the teeth of *Vespertilio murinus* show certain notable peculiarities. Inner upper incisor similar to that of *Eptesicus serotinus* when viewed from in front, but with well developed postero-basal cusp which in some specimens rises nearly to half the height of main cusp, producing a distinctly trifid tooth; outer incisor with crown area slightly less than that of inner, the cusp rising nearly to middle of shaft of inner tooth; secondary cusp slightly developed; position of incisors relatively to tooth-row about as in *E. nilssonii*. Lower incisors as in *E. nilssonii*. Upper canine with transverse diameter slightly greater than longitudinal diameter, the reverse of the condition in the two species of *Eptesicus;* lower canine with same peculiarity in outline of crown though to a less degree. Upper premolar with longitudinal diameter of crown relatively

CRANIAL MEASUREMENTS OF *VESPERTILIO MURINUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case at middle.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
Sweden: no exact locality .	46. 6. 2. 21		14·8	9·2	4·4	6·2	8·0	—	10·8	5·2	5·6	Teeth not worn.
Denmark: no exact locality .	38356	♂	14·6	9·8	4·4	6·0	7·8	5·0	—	5·2	5·8	,, ,,
,, ,, .	62685	♂	15·2	10±	4·2	5·8	8·2	5·0	—	5·2	5·8	,, moderately worn.
,, ,, .	62688	♀	14·2	9·8	4·2	5·6	7·8	5·0	10·8	5·2	5·6	,, not worn.
Germany: Bavaria . . .	37530		14·6	—	4·0	5·8	7·8	5·0	11·2	5·2	5·6	,, ,,
,, . . .	37570		14·4	—	4·0	5·8	—	5·0	11·0	5·2	5·4	,, ,,

less than in the European species of *Eptesicus*, and antero-internal basal cusp better developed: lower premolars more crowded and compressed than in *E. nilssonii*, and crown area of first relatively smaller. Molars as in *E. nilssonii* except that columnar hypocone of m^1 and m^2 stands out more prominently from outline of protocone.

Measurements.—Three adult males from Denmark: head and body, 62, 59 and 62; tail, 43, 40 and 44; tibia, 17·4, 16·8 and 16·8; foot, 9·6, 9·2 and 10; **forearm**, 43·4, 44 and 43; thumb, 7, 7·4 and 7·6; third finger, 73, 76 and 74; fifth finger, 52, 54 and 53; ear from meatus, 15, 15 and 15·6; width of ear, 16, 16 and 17. Adult female from the same locality: head and body, 63; tail, 41; tibia, 16·4; foot, 9; **forearm**, 45; thumb, 8; third finger, 78; fifth finger, 54; ear from meatus, 16; width of ear, 17. Adult male from Morat, Fribourg, Switzerland: head and body, 56; tail, 42; tibia, 16; foot, 8·8; **forearm**, 45; thumb, 5·4; third finger, 76; fifth finger, 55; ear from meatus, 12; width of ear, 12·4. For cranial measurements see Table, p. 241.

Specimens examined.—Twelve, from the following localities:—
England: Plymouth, 1.
Sweden: No exact locality, 1.
Denmark: No exact locality, 4 (U.S.N.M.).
Germany: Gross Hennersdorf, Saxony, 1; Bavaria, 2 (U.S.N.M.).
Austria-Hungary: Csallóköz-Somorja, Pressburg, 1.
Switzerland: Morat, Fribourg, 1 (Mottaz).
Locality unknown: One; type of *albigularis* Peters (Berlin).

Remarks.—Superficially this bat somewhat resembles *Eptesicus nilssoni*. It is readily distinguishable, however, by its slightly larger size (forearm, 43 to 45 instead of 38 to 40), low, rounded ear, and by the whitish rather than yellowish wash on back.

1.	Plymouth, Devonshire, England.	Dr. Leach (P).	37. 4.
—	Sweden.	Stockholm Museum (E).	46. 6. 2. 21.
♀.	Gross Hennersdorf, Saxony (*W. Baer.*)	Lord Lilford (P).	99. 1. 9. 5.
1.	Csallóköz-Somorja, Pressburg, Hungary.	Budapest Museum (E).	94. 3. 1. 15.

Genus **NYCTALUS** Bowdich.

1825. *Nyctalus* Bowdich, Excursions in Madeira and Porto Santo, p. 36 (*verrucosus*).
1829. *Pterygistes* Kaup, Entw.-Gesch. u. Natürl. Syst. Europ. Thierwelt, I, p. 99.
1839. *Vesperugo* Keyserling and Blasius, Wiegmann's Archiv für Naturgesch., 1839, I, p. 312 (part).
1842. *Noctulinia* Gray, Ann. and Mag. Nat. Hist., X, p. 258 (part; contained *proterus* = *noctula* and *fulvus* = *Scotophilus kuhlii*).
1856. *Panugo* Kolenati, Allgem. deutsche Naturhist. Zeitung, Dresden, neue Folge, II, p. 131 (*noctula* and *leisleri*).
1857. *Vesperugo* Blasius, Säugethiere Deutschlands, p. 49 (part).

1878. *Vesperugo* Dobson, Catal. Chiropt. Brit. Mus., p. 183 (part).
1893. *Noctulinia* H. Allen, Proc. U.S. National Museum, XVI, p. 30, June 13, 1893.
1897. *Pterygistes* Miller, Ann. and Mag. Nat. Hist., 6th ser., XX, p. 384, October, 1897.
1899. *Euvesperugo* Acloque, Faune de France, Mammifères, p. 32 (part, included *noctula*, *leisleri*, *maurus*, *kuhlii*, *pipistrellus*, and *abramus*).
1907. *Pterygistes* Miller, Families and Genera of Bats, p. 207, June 27, 1907.
1908. *Nyctalus* Andersen, Ann. and Mag. Nat. Hist., 9th ser., I, p. 434, May, 1908.

Type species.—*Nyctalus verrucosus* Bowdich.

Geographical distribution.—Northern portion of Eastern Hemisphere from the Azores and Madeira to Japan.

Characters.—Dental formula as in *Pipistrellus;* skull with nares extending unusually far back, half way to interorbital constriction, and with large anterior palatal emargination; fifth finger much shortened, scarcely exceeding metacarpal of fourth or third.

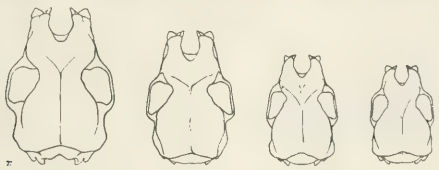

FIG. 43.

Nyctalus maximus (a), *N. noctula* (b), *N. leisleri* (c), and *N. azoreum* (d). Nat. size.

Remarks.—This genus is well differentiated from allied groups by the peculiar narrowing of the wing due to the shortness of the fifth finger. Three of the half dozen known species occur on the continent of Europe, while a fourth inhabits the Azores. The most obvious character by which the European forms are distinguished is the size of the skull (see fig. 43).

KEY TO THE EUROPEAN SPECIES OF *NYCTALUS*.

Condylobasal length of skull more than 17 mm.; forearm more than 45 mm.; hairs of back without dark bases.
  Condylobasal length of skull 22 to 23 mm.; forearm 64 to 68 mm. (Southern Europe) ..... *N. maximus*, p. 244.
  Condylobasal length of skull 17·4 to 19·4 mm.; forearm 47 to 55 mm. (Distribution general) ..... *N. noctula*, p. 245.
Condylobasal length of skull less than 17 mm.; forearm less than 45 mm.; hairs of back with noticeable dark bases.
  Condylobasal length of skull 15 to 16 mm.; forearm 39 to 43 mm. (Distribution general) ..... *N. leisleri*, p. 252.
  Condylobasal length of skull 13 to 14·2 mm.; forearm 35 to 42 mm. (Azores) ..... *N. azoreum*, p. 254.

NYCTALUS MAXIMUS Fatio.

1781. ? *Vespertilio lasiopterus* Schreber, Säugethiere, pl. LVII B. See Thomas, Ann. and Mag. Nat Hist., 8th ser., VIII, pp. 379-380, September, 1911.
1827. ?? *Vespertilio ferrugineus* Brehm, Ornis, Heft III, p. 26 (Renthendorf, Thüringen, Germany).
1869. [*Vesperugo noctula*] var. *maxima* Fatio, Faune Vert. Suisse, I, p. 57. Co-type in Geneva Museum.
1900. *Pterygistes maximus* Miller, Proc. Biol. Soc. Washington, XIII, p. 156, June 13, 1900.
1910. *Nyctalus maximus* Trouessart, Faune Mamm. d'Europe, p. 19.

Type locality.—Amsteg, Uri, Switzerland.

Geographical distribution.—At present known from a few localities in Switzerland and Italy.

Diagnosis.—Essentially similar to *Nyctalus noctula* but much larger; condylobasal length of skull, 22 to 23 mm.; forearm, 64 to 68 mm.

External characters.—Except for the conspicuously greater size and consequent more robust form, there appears to be no tangible character by which the animal can be distinguished from *N. noctula*.

Fur and colour.—In the few specimens examined the furred area on under surface of wing membrane behind forearm appears to be better defined than in *N. noctula*. Colour as in the common species.

Skull and teeth.—The skull and teeth so closely resemble those of *Nyctalus noctula* that in general they differ in their greater size only. The posterior portion of occiput is, however, more elevated above base of cranium than in the smaller animal, so that lower edge of condyle is about on level with anteorbital foramen and alveolus of canine instead of distinctly below them. Correlated with this character is a more abrupt rising of lambdal region above level of anterior portion of brain-case, and a less nearly horizontal truncation of occipital region. Palate apparently more concave longitudinally than in any of the smaller European species.

Measurements.—Adult male and female from Pisa, Italy: head and body, 78 and 87; tail, 59 and 66; tibia, 23·6 and 24; foot, 12 and 13; **forearm**, 65 and 68; thumb, 11 and 11; third finger, 119 and 123; fifth finger, 76 and 77; ear from meatus, 21 and 22; width of ear, 23 and 24. Adult male from Venice:* head and body, 92; tail, 65; tibia, 26; foot, 14; **forearm**, 67. Adult female from Amsteg, Uri, Switzerland: head and body, 90±; tibia, 21·6; foot, 13; **forearm**, 64; thumb, 9·4; third finger, 114; fifth finger, 72. For cranial measurements see Table, p. 250.

Specimens examined.—Five, from the following localities:—
SWITZERLAND: Amsteg, Uri, 1 (Geneva; co-type).
ITALY: Pisa, 3 (B.M. and U.S.N.M.); Ravenna, 1.

* Ninni, Atti Soc. Ital. Sci. Nat., Milano, XXVI, p. 109, 1883.

Remarks.—*Nyctalus maximus* is readily distinguished among the bats of Europe by its large size. It is at present a rare and little known animal.

♀ al.	Pisa, Italy.	Dr. A. Senna (E).	94. 6. 3. 3.
♂ al.	Ravenna.	Florence Museum (E).	85. 7. 6. 9.
♂ al.		Lidth de Jeude Coll.	67. 4. 12. 337.

NYCTALUS NOCTULA Schreber.

1774. *Vespertilio noctula* Schreber, Säugthiere, I, pl. LII; description, I, p. 166, under name: Die Speckmaus (France; based primarily on "La Noctule" of Daubenton, Hist. Acad. Royale des Sci., Paris, 1759, p. 376. 1765).

1776. *Vespertilio lardarius* P. L. S. Müller, Natursyst. Suppl. u. Regist.-Band, p. 15 (France; based primarily on Schreber's Speckmaus).

1789. [*Vespertilio*] *magnus* Borkenhaut, Syn. Nat. Hist. Great Britain and Ireland, I, p. 1 (Cambridge, England; based on Pennant, Brit. Zool., No. 38).

1789. *Vespertilio altivolans* White, Nat. Hist. and Antiquities of Selborne, p. 93 (Selborne, Hampshire, England).

1816. ? *Vespertilio major* Leach, Syst. Catal. Spec. Indig. Mamm. and Birds Brit. Mus. (Willoughby Society reprint, 1882), p. 5 Nomen nudum: "Great Bat."

1818. *Vespertilio proterus* Kuhl, Ann. Wetterau, Gesellsch. Naturk, IV (= Neue Ann., I), pt. 1, p. 41 (Substitute for *noctula*).

1829. *Vespertilio rufescens* Brehm, Isis, p. 643 (Jena, Thüringen, Germany).

1841. *Vespertilio noctula* Bonaparte, Iconogr. Faun. Ital., I, Ind. Distrib. (sp. illustr.).

1841. *Noctula serotina* Bonaparte, Iconogr. Faun. Ital., I, Ind. Distrib. (nomencl. moderna).

1844. *Vesp*[*ertilio*] *palustris* Crespon, Faune Méridionale, I, p. 22 (marshes near Nîmes, Gard, France).

1857. *Vesperugo noctula* Blasius, Säugethiere Deutschlands, p. 53.

1869. [*Vesperugo noctula*] var. *minima* Fatio, Faune Vert. Suisse, I, p. 58 (Geneva, Switzerland).

1878. *Vesperugo noctula* Dobson, Catal. Chiropt. Brit. Mus., p. 212.

1897. *Pterygistes noctula* Miller, Ann. and Mag. Nat. Hist., 6th ser., XX, p. 384, October, 1897.

1910. *Nyctalus noctula* Trouessart, Faune Mamm. d'Europe, p. 18.

Type locality.—France.

Geographical distribution.—Europe from southern Norway and central Sweden to the Mediterranean, and from England eastward into Asia.

Diagnosis.—Condylobasal length of skull, 17·4 to 19·4 mm.; forearm, 47 to 55 mm.; general colour dark yellowish brown, the hairs not darker at base.

External characters.—General form robust and heavy. Muzzle broad, with conspicuous glandular swelling between eye and nostril, the greatest width across this region decidedly more than distance between nostril and ear; nostrils projecting forward and outward with evident median concavity between them, the orifice crescentic. Ear short, extending when laid forward about half

way from eye to nostril, its breadth when flattened decidedly greater than height above crown; anterior border of conch abruptly convex below, then nearly straight to broadly rounded off extremity; posterior border convex throughout, most strongly at middle; antitragus long and low, well marked off posteriorly, its anterior border extending to just below angle of mouth; inner surface of conch finely papillose, without evident cross ridges; tragus very short, scarcely rising above level of anterior base of conch, much wider above than below, its greatest width about equal to height; anterior and posterior borders concave, the anterior more so than posterior, their length about equal to that of expanded upper portion, which is more abruptly rounded anteriorly than posteriorly. Wing long and slender, the fifth finger exceeding forearm by only $\frac{1}{7}$ to $\frac{1}{6}$ length of latter, the membrane leathery and opaque, joining leg at ankle; third and fourth metacarpals sub-equal, the third slightly the longer and about equal to forearm, fifth abruptly shorter by slightly more than one-fifth forearm. Leg short and strong, the broad foot about one-half as long as tibia; calcar $1\frac{1}{2}$ to twice as long as tibia or as free border of interfemoral membrane, its distal termination obscure but basal portion strong, well defined and with keel about 2·5 mm. wide supported by a well defined thickening and terminating in an abrupt convexity on side nearest heel. Tail rather short, extending to between shoulders when laid forward, the tip of last vertebra (about 2 mm.) free.

Fur and colour.—Fur dense and velvety, the hairs at middle of back only about 5 mm. in length; on dorsal surface of wing it extends to line joining knee with middle of humerus, on ventral surface to line from elbow to knee; beyond this line it spreads thinly on under surface of antebrachial membrane and also behind forearm and across bases of metacarpals along an area about 10 mm. wide. Interfemoral membrane furred both above and below at extreme base only. Colour of upper parts a rather dark yellowish brown, near the wood-brown and cinnamon of Ridgway, the hairs showing a faint clouding of prouts-brown in certain lights, their basal portion a light dull isabella-colour; underparts scarcely different from back, though usually a little lighter and more dull; muzzle and cheeks dusky; ears and membranes blackish.

Skull.—General aspect of skull broad and robust, rather high posteriorly, low anteriorly, with conspicuous narial emargination. Dorsal profile rising rather rapidly from incisors to lambda, with slight convexity over lachrymal region and a slighter though more abrupt concavity just in front of lambda. Ventral profile elevated posteriorly. Brain-case ovate, but with wide mastoid and paroccipital region and squarely truncate occiput which together produce a distinctly truncate-cuneate outline, slightly though evidently wider than long; depth at middle distinctly more than half mastoid breath; sagittal crest low but evident,

the region on each side of it flat or slightly depressed; lambdoid crest high, curved abruptly forward at point of junction with sagittal crest; floor of brain-case with small but evident lateral pits, well defined anteriorly but communicating posteriorly with vacuity between cochlea and basioccipital; auditory bullæ well developed but of moderate size, the transverse diameter about equal to distance between bullæ. Interorbital region deeply constricted, short hour-glass shaped, the lachrymal region widening abruptly to a breadth nearly equal to that of brain-case, and forming a slight though evident tubercular projection over anterior rim of orbit; rostrum squarish, somewhat narrower anteriorly than posteriorly, the oval or ovate narial emargination extending back to level of lachrymal foramen; rostral depth at front of orbit about equal to distance from orbit to front of inner incisor; anteorbital foramen small, over space between large premolar and first molar, lachrymal foramen slightly above and behind it, on orbital rim. Palate rather short, owing to the large size of the anterior emargination, the posterior edge of which is on level with middle of large premolar, rather evidently concave laterally, less so longitudinally. Posterior extension of palate nearly parallel sided, its width at level of posterior edge of third molar slightly less than length; hamulars barely turned inward; median spine large, acute. Mandible robust, noticeably deeper at symphysis than immediately behind tooth-row; posterior portion rather low and long, the height of coronoid process above alveolus less than least length, the upper border sloping gradually from coronoid to articular process; angular process moderately long, about on level with alveolar line, its main axis directed rather abruptly outward, its distal extremity obliquely widened.

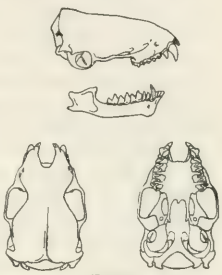

FIG. 44.
Nyctalus noctula.
Nat. size.

Teeth.—Relatively to size of skull the teeth are large, though the cusps are rather low. Inner upper incisor slender, with slightly developed cingulum, its crown area barely one quarter that of canine, the nearly terete shaft directed obliquely inward, its apex extending slightly beyond level of cingulum of canine, its secondary cusp small but evident, situated on postero-external surface of shaft; outer upper incisor with crown area distinctly greater than that of inner tooth, the shaft deeply concave, its concavity directed outward and backward, the main cusp lying close against secondary cusp of inner tooth, the well-defined secondary cusp relatively much larger than that of inner incisor, cingulum well developed, bearing a small but distinct antero-external cusp on opposite side of concavity from secondary cusp. The two

incisors are closely crowded against each other ; outer tooth separated from canine by a very narrow space. Lower incisors rather strongly imbricated, forming a very broadly U-shaped row between canines, the crowns of i_1 and i_2 compressed, trifid, that of i_3 sub-terete, flattened anteriorly, with two low posterior tubercles in addition to the three cusps corresponding to those of other teeth. Upper canine robust, with well developed anterior and posterior cutting edge, the shaft triangular in cross-section ; cingulum well developed but without true secondary cusps. Lower canine with posterior surface of shaft strongly concave, the well developed cingulum forming a postero-internal basal cusp and a conspicuous secondary cusp near middle of antero-internal border of shaft ; diameter of crown distinctly less than distance between canines. Anterior upper premolar minute, closely wedged in space between canine and posterior premolar, its cross-section less than half that of incisors, its crown reniform in outline, its cusp low but distinct ; posterior upper premolar with crown area somewhat more than half that of first molar, the protocone well developed, nearly as high as in molars, the main cusp rather high but much shorter than canine (measured along cingulum), its two cutting edges well developed. Lower premolars closely crowded, their crowns about equal in cross-section and somewhat more than half that of canine, the shaft of first lower and more robust than that of second and about half as high as canine ; cingulum well developed, in each tooth forming a small but evident antero-internal and postero-internal cusp. First and second upper molars with crowns rather broad on inner side, the posterior emargination slight ; protocone robust but low ; hypocone small but well developed and distinct from commissure of protocone ; outer cups without special peculiarities, the styles low but well developed, the W-pattern normal, m^3 with crown area distinctly more than half that of m^1, its longitudinal diameter through metacone about half transverse diameter, its three cusps, two styles and three commissures well developed, but proportion between paracone and metacone reversed as compared with other molars. Lower molars with unusually robust hypoconid and entoconid, producing a strong contrast in size between the anterior and posterior V in m_1 and m_2 and approximate equality in m_3 ; cingulum well developed but not forming basal cusp behind entoconid.

Measurements.—Adult female from Kew Gardens, Surrey, England : head and body, 71 ; tail, 51 ; tibia, 18 ; foot, 10 ; **forearm**, 52 ; thumb, 9 ; third finger, 94 ; fifth finger, 58 ; ear from meatus, 15 ; width of ear, 16. Adult female from Herrnhut, Saxony, Germany : head and body, 79 ; tail, 53 ; tibia, 19 ; foot, 10·6 ; **forearm**, 53 ; thumb, 9·4 ; third finger, 97 ; fifth finger, 60 ; ear from meatus, 17 ; width of ear, 17. Two adult males from Pisa, Italy : head and body, 70 and 71 ; tail, 49 and 52·6 ; tibia, 18 and 19 ; foot, 10 and 11 ; **forearm**, 51 and 53 ;

thumb, 8 and 9 ; third finger, 92 and 97 ; fifth finger, 56 and 59 ; ear from meatus, 14·6 and 16 ; width of ear, 14 and 15·6. Two adult females from the same locality : head and body, 74 and 75 ; tail, 50 and 53 ; tibia, 18·6 and 18 ; foot, 10 and 11 ; **forearm,** 51·6 and 52 ; thumb, 9 and 10 ; third finger, 93 and 97 ; fifth finger, 57 and 58 ; ear from meatus, 16 and 16 ; width of ear, 16 and 16. Two adult females from Corinth, Greece : head and body, 69 and 76 ; tail, 51 and 54 ; tibia, 18 and 19 ; foot, 11 and 10 ; **forearm,** 52 and 54 ; thumb, 9·4 and 9·4 ; third finger, 96 and 102 ; fifth finger, 58 and 62 ; ear from meatus, 15·6 and 16 ; width of ear, 15 and 16. For cranial measurements see Table, p. 250.

Specimens examined.—One hundred and fourteen, from the following localities :—

England : Bowdon, Cheshire, 1; Stoke, Staffordshire, 1; Oundle, Northamptonshire, 4; Bedfordshire, 1; Trumpington, Cambridgeshire, 1; Cambridgeshire, no exact locality, 1; Henley-on-Thames, Oxfordshire, 1; Sandringham, Norfolk, 1; Kingsbury, Middlesex, 1; Chelmsford, Essex, 1; Wellyn, Hertfordshire, 1; Tring, Hertfordshire, 3; Wandsworth Common, Surrey, 1; Shalford, Surrey, 2; Earlsfield, Surrey, 5; Kew Gardens, Surrey, 1 (U.S.N.M.); Fulham Park, London, 1; Eastwell, Kent, 2; St. Leonards, Sussex, 1; Farnborough, Hampshire, 1; Wareham, Dorsetshire, 1.

Holland : Oosterbeek, Guelderland, 1.

Germany : Moritzburg, Saxony, 3 (U.S.N.M.); Herrnhut, Saxony, 2 (B.M. and U.S.N.M.); Niesky, Silesia, 1; Schwarzburg, Thüringen, 2; Strass, near Burgheim, Bavaria, 3; Bavaria, no exact locality, 8 (U.S.N.M.); Stuttgart, 1.

Austria-Hungary : Csallóköz-Somorja, Pressburg, Hungary, 2.

Roumania : Gageni, 1; Bustenari, 1; no exact locality, 1 (U.S.N.M.).

Switzerland : Geneva, 4 (Geneva and Mottaz); St. Margarethen, Appenzell, 8 (B.M. and U.S.N.M.).

Spain : Seville, 4; no exact locality, 2.

Italy : Pisa, 18 (U.S.N.M.); Florence, 4 (Mottaz); Vallombrosa, near Florence, 1 (U.S.N.M.); Siena, 1; Rome, 2.

Greece : Corinth, 12 (U.S.N.M.).

Remarks.—This is one of the most widely distributed and abundant of the larger European bats. From *Eptesicus serotinus*, the only species with which it is likely to be confused, it is easily distinguished by the narrow wing, short, recurved tragus, and low, rounded ear.

♂.	Aberia, Merionethshire, Wales.	Col. Yerbury (C & P).	11. 1. 3. 26.
♀.	Bowdon, Cheshire, England. (*T. A. Coward.*)	G. Barrett-Hamilton (P).	11. 1. 2. 100.
2 ♂, 2 ♀.	Oundle, Northamptonshire.	Lord Lilford (P).	11. 1. 1. 126–127. 11. 1. 1. 129–130.
♀.	Bedfordshire.	J. S. Elliot (C & P).	11. 1. 3. 391.
1.	Trumpington, Cambridgeshire.	G. Barrett-Hamilton (P).	11. 1. 2. 101.
♀ al.	Cambridgeshire.	Rev. L. Jenyns (C & P).	———

Locality.	Number.	Sex.	Condylo-basal length.	Zygomatic breadth.	Interorbital constriction.	Length of palate.	Length of molar series.	Depth of ramus below m.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
N. maximus.												
Switzerland: Amsteg, Uri	Geneva Mus.*	♀	22·4	14·6	6·0	9·6	11·6	7·4	17·8	8·8	9·6	Teeth slightly worn.
Italy: Pisa	91. 6. 3. 3	♀	22·8	15·0	5·8	9·8	11·2	7·2	17·1	8·8	9·4	,, not worn.
,,	86624	♀	22·2	15·4	6·0	10·0	11·6	7·6	17·6	9·2	9·8	,, slightly worn.
,,	86623	♂	22·2	15·0	6·0	9·4	11·6	7·2	17·4	9·0	9·8	,, ,,
Ravenna	85. 7. 6. 9	♂	22·8	15·6	5·6	9·8	11·6	7·2	17·6	8·8	9·6	,, ,,
,,	84551	♂	22·6		5·8	9·6			17·8	8·8	9·6	,, ,,
N. noctula.												
England: Wellyn, Hertfordshire	11. 1. 3. 33	♀	18·8	13·0	5·2	8·4	10·0	6·2	14·4	7·4	7·6	,, ,,
Shalford, Surrey	11. 1. 3. 34	♂	18·2	12·8	5·0	8·4	9·8	6·2	14·2	7·2	7·8	,, moderately worn.
Earlsfield ,,	11. 1. 3. 29	♂	18·4		5·0	8·0	10·0	6·4	14·0	7·2	7·8	,, slightly worn.
,, ,,	11. 1. 3. 30	♂	18·8	13·2	5·0	8·6	9·8	6·6	14·4	7·2	7·8	,, moderately worn.
,, ,,	11. 1. 3. 28	♂	18·0	13·0	5·0	8·6	10·0	6·2	13·8	7·0	7·4	,, much worn.
Kingsbury, Middlesex	79. 9. 25. 75	♀	18·8	13·2	5·0	8·0	9·8	6·0	14·0	7·4	8·0	,, not worn.
Oundle, Northampton	11. 1. 1. 129	♂	18·2	13·0	5·0	8·2	9·8	6·0	14·0	7·0	7·8	,, slightly worn.
,, ,,	11. 1. 1. 130	♀	18·2	13·0	5·0	8·0	9·6	6·0	13·8	7·0	7·6	,, ,,
Chelmsford, Essex	11. 1. 3. 31	♀	17·8	12·8	5·0	7·8	9·8	6·0	14·0	7·0	7·8	,, not worn.
Holland: Oosterbeek, Guelderland	98. 2. 1. 5	♂	18·6	13·4	5·4	8·8	10·0	6·0	14·2	7·2	7·8	,, moderately worn.
Germany: Schwarzburg, Thüringen	95. 1. 18. 1	♂	19·0	13·8	5·2	8·8	10·4	6·0	14·4	7·4	8·0	,, ,,
,, ,,	95. 4. 18. 2	♀	18·8	13·0	5·4	8·2	9·8	6·0	14·4	7·2	7·6	,, slightly worn.

Germany: Strass, near Burgheim	11. 1. 1. 30	♂	18·4	13·0	5·0	8·0	10·0	6·4	14·0	7·2	8·0	Teeth slightly worn.
,, ,,	152574	♂	18·8	—	5·4	8·8	10·2	6·2	14·6	7·2	7·6	,, moderately worn.
,, ,,	11. 1. 1. 31	♂	18·4	13·0	5·0	8·0	9·6	6·4	14·0	7·2	7·6	,, ,,
Niesky, Silesia . .	99. 1. 9. 7		18·6	13·0	5·0	8·0	9·6	6·0	14·0	7·2	7·6	,, not worn.
Switzerland: Geneva . .	Geneva Mus.	♀	18·0	13·4	5·2	8·2	9·8	6·2	14·2	7·2	7·8	,, moderately worn.
,, . .	1002 Mottaz	♂	19·4	13·4	5·4	8·8	10·2	6·4	14·2	7·4	7·8	,, slightly worn.
,, . .	1003 ,,	♂	19·2	13·4	5·2	8·8	10·0	6·4	14·4	7·2	7·8	,, moderately worn.
St. Margarethen, Appenzell .	4. 4. 5. 15	♂	18·0	12·4	5·0	8·0	9·8	5·8	14·0	7·0	7·6	,, not worn.
,, ,, .	4. 4. 5. 16	♂	18·0	12·4	5·0	7·8	9·6	5·8	14·0	7·0	7·6	,, ,,
,, ,, .	4. 4. 5. 17	♂	18·0	13·0	5·0	7·6	9·6	6·0	14·2	7·2	7·6	,, ,,
,, ,, .	4. 4. 5. 18	♀	18·2	12·8	5·0	8·0	9·6	5·8	14·0	7·0	7·4	,, ,,
,, ,, .	4. 4. 5. 19	♀	18·6	13·0	5·2	8·2	9·8	6·2	14·2	7·2	7·4	,, ,,
Italy: Pisa	86615	♂	18·2	12·8	5·0	7·8	9·6	6·6	14·2	7·2	7·8	,, ,,
,, ...	86619	♂	18·0	—	4·8	8·6	9·6	6·2	14·2	7·0	7·8	,, ,,
,, ...	86620	♂	17·8	—	4·8	8·0	9·4	6·2	13·6	7·2	7·8	,, ,,
,, ...	86621	♂	18·2	13·4	5·4	8·8	10·0	6·4	13·8	7·0	7·6	,, moderately worn.
,, ...	86613	♀	17·6	12·4	5·0	7·8	9·8	6·6	13·6	6·8	7·4	,, not worn.
,, ...	86616	♀	17·8	—	5·0	8·0	9·6	6·6	13·8	7·0	7·6	,, ,,
,, ...	86617	♀	17·6	12·2	4·8	7·8	9·6	6·0	13·6	7·0	7·6	,, slightly worn.
,, ...	86618	♀	17·4	12·8	5·0	8·0	9·6	6·6	13·6	7·2	7·4	,, not worn.
Greece: Corinth . . .	145221	♀	18·6	13·2	5·0	8·0	9·8	6·4	14·2	7·0	7·4	,, slightly worn.
,, . . .	145223	♀	17·8	—	5·2	8·6	10·0	6·6	14·2	7·0	7·4	,, ,,
,, . . .	145224	♀	18·2	13·2	5·2	8·6	9·8	6·6	14·2	7·2	7·8	,, ,,
,, . . .	145225	♀	17·8	13·2	5·2	8·0	10·0	6·8	13·8	7·2	7·6	,, not worn.
,, . . .	145226	♀	18·0	13·0	5·2	8·0	9·8	6·4	14·0	7·0	7·2	,, slightly worn.
,, . . .	145228	♀	17·8	—	5·2	8·2	10·0	6·2	14·0	7·0	7·8	,, ,,
,, . . .	145229	♀	18·2	—	5·4	8·2	10·0	6·4	14·0	7·0	7·4	,, ,,
,, . . .	145230	♀	18·8	13·8	5·2	8·0	10·0	6·4	14·6	7·2	8·0	,, moderately worn.

* Co-type.

♂.	Henley-on-Thames, Oxfordshire.	Heatley Noble (C & P).	11. 1. 3. 40.
♂ st.	Sandringham, Norfolk.	H.M. King Edward VII. (P).	96. 7. 27. 1.
♀.	Chelmsford, Essex.	M. Christy and L. E. Thompson (C & P).	11. 1. 3. 41.
♀.	Wellyn, Hertfordshire.	C. H. B. Grant (C & P).	11. 1. 3. 33.
2 ♂, ♀ st.	Tring, Hertfordshire.	Hon. N. C. Rothschild (C & P).	1. 5. 22. 1–3.
2 ♂.	Shalford, Surrey.	W. R. Ogilvie-Grant (C & P).	11. 1. 3. 34–35.
3 ♂, 2 ♀.	Earlsfield, Surrey.	C. H. B. Grant (C & P).	11. 1. 3. 28–32.
♂ st.	Fulham Park. London.	J. Saunders (C & P).	87. 7. 22. 1.
♂, ♀.	Eastwell, Kent.	C. H. Caton-Haigh (C & P).	11. 1. 3. 36–37.
♀.	St. Leonards, Sussex.	R. Butterfield (C & P).	11. 1. 3. 392.
♂.	Farnborough, Hampshire.	H. S. Scott (C & P).	11. 1. 3. 39.
♀.	Wareham, Dorset.	W. T. Blanford (C & P).	11. 1. 3. 38.
♂.	Oosterbeek, Guelderland, Holland.	O. Thomas (C & P).	98. 2. 1. 5.
♀.	Niesky, Silesia, Germany. (*W. Baer.*)	Lord Lilford (P).	99. 1. 9. 7.
♂.	Schwartzburg, Thüringen, 200 m.	Lord Lilford (P).	95. 4. 18. 1.
3 ♂.	Strass, Burgheim, Bavaria. (*Körbitz.*)	Lord Lilford (P).	11. 1. 1. 30–32.
1 al.	Stuttgart, Wurtemburg.	Dr. A. Günther (P).	66. 2. 1. 6.
2.	Csallóköz-Somorja, Pressburg, Hungary.	Budapest Museum (E).	94. 3. 1. 16–17.
♂.	Gageni, Prahova, Roumania. (*W. Dodson.*)	Lord Lilford (P).	4. 4. 6. 4.
♀.	Bustenari, Prahova. (*W. Dodson.*)	Lord Lilford (P).	4. 4. 6. 5.
2 ♂, 3 ♀.	St. Margarethen, Appenzell, Switzerland. (*E. H. Zollikofer.*)	O. Thomas (P).	4. 4. 5. 15–19.
4 al.	Seville, Spain. (*A. Ruiz.*)	Seville Museum (E).	94. 5. 8. 1–4.
2 al.	Spain.	Lord Lilford (P).	72. 8. 21. 1–2.
♂ juv. al.	Rome.	Florence Museum (E).	85. 7. 6. 8.

NYCTALUS LEISLERI Kuhl.

1818. *Vespertilio leisleri* Kuhl, Ann. Wetterau. Gesellsch. Naturk., IV (= Neue Ann., I), pt. 1, p. 46.

1818. *Vespertilio dasycarpos* Kuhl, Ann. Wetterau. Gesellsch. Naturk., IV (= Neue Ann., I), pt. 1, p. 49 (Alternative name for *leisleri*).

1839. *Vespertilio pachygnathus* Michahelles in Wagner, Schreber's Säugthiere, Suppl., I, pl. LV B (Dalmatia. See Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LXII, Abth. I, p. 222, 1870).

1857. *Vesperugo leisleri* Blasius, Säugethiere Deutschlands, p. 56.

1878. *Vesperugo leisleri* Dobson, Catal. Chiropt. Brit. Mus., p. 215.

1910. *Nyctalus leisleri* Trouessart, Faune Mamm. d'Europe, p. 19.

Type locality.—Hanau, Hessen-Nassau, Germany.
Geographical distribution.—Central Europe, west to Ireland.
Diagnosis.—Like *Nyctalus noctula* but not so large; condylo-

basal length of skull, 15 to 16 mm. ; forearm, 39 to 43 mm. ; basal portion of fur conspicuously darkened.

Colour.—The colour is usually a brown, darker than in *N. noctula*, nearly the prout-brown of Ridgway, with or without a lighter, wood-brown tinge, and usually showing drab or isabella reflections in certain lights, the underparts not so dark as back ; hairs everywhere blackish (seal-brown) through basal half. Ears and membranes (dry) blackish. Two skins are a pale buffy wood-brown throughout except for the usual dark bases of the hairs.

Skull and teeth.—Except for its smaller size and more delicate structure the skull does not differ appreciably from that of *Nyctalus noctula*. Teeth essentially as in the larger species, but crown area of upper incisors nearly equal, and lower incisor row forming a deeper, almost V-shaped convexity.

Measurements.—External measurements of adult male from Co. Wicklow, Ireland : head and body, 60 ; tail, 39 ; tibia, 16·2 ; foot, 8·2 ; **forearm,** 42 ; third finger, 78 ; fourth finger, 48 ; ear from meatus, 13. Adult female from Co. Armagh, Ireland : head and body, 63 ; tail, 42 ; tibia, 16·6 ; foot, 8 ; **forearm,** 42 ; third finger, 76 ; fifth finger, 49 ; ear from meatus, 14 ; width of ear, 14. Two adults from Welford, Warwickshire, England : **forearm,** 40·4 and 41·4. Adult from Meiringen, Bern, Switzerland : **forearm,** 40. For cranial measurements see Table, p. 255.

Specimens examined.—Eleven, from the following localities :—
IRELAND : Belfast, 1; Bray, Co. Wicklow, 2; Co. Armagh, 2.
ENGLAND : Mexbro', Yorkshire, 1; Welford, Warwickshire, 2; Cleeve Priory, 1; no exact locality, 1.
ROUMANIA : Bustenari, Prahova, 1.
SWITZERLAND : Meiringen, Bern, 1.

Remarks.—Though its smaller size is the most obvious character of this species as compared with *N. noctula*, the bicolored fur, the different relative sizes of the upper incisors, and the more abrupt convexity of the mandibular incisor series would by themselves be quite sufficient to distinguish it.

♀.	Belfast, Ireland.	G. Barrett-Hamilton (P.)	1. 3. 15. 1.
♂ al.	Bray, Wicklow.	J. E. Harting (C & P).	90. 2. 14. 1.
♀ al.	Armagh.	Dr. G. E. Dobson (C & P).	89. 11. 12. 5.
♀ al.	Armagh.	R. M. Barrington (C & P).	74. 5. 28. 8.
2 ♀.	Welford, Warwickshire, England.	Tomes Collection.	7. 1. 1. 386–387.
♂.	Cleeve Priory, Warwickshire.	Tomes Collection.	7. 1. 1. 388.
1.	England.	Dr. Leach (P).	63. A.
♂.	Bustenari, Prahova, 840 m. Roumania. (*W. Dodson.*)	Lord Lilford (P).	4. 4. 6. 6.
1.	Meiringen, Bern, Switzerland.	Tomes Collection.	7. 1. 1. 389.

NYCTALUS AZOREUM Thomas.

1901. *Pterygistes azoreum* Thomas, Ann. and Mag. Nat. Hist., 7th ser., VIII, p. 33, July, 1901. Type in British Museum.

Type locality.—St. Michael, Azores.

Geographical description.—Azores.

Diagnosis.—Smaller than *Nyctalus leisleri* (condylobasal length of skull, 13 to 14·2 mm.; forearm, 35 to 42 mm.); colour darker than in the Continental European species.

External characters.—Except for its conspicuously smaller size *Nyctalus azoreum* does not differ appreciably in external features from *N. noctula*. The fifth finger shows a tendency to be less shortened relatively to length of forearm, but this is apparently not constant enough to be regarded as a specific character.

Colour.—Upper parts prout-brown, the hairs with darker, ill-defined slaty basal area, and usually with lighter tips, the lighter colour ranging in different individuals from raw-umber through wood-brown to a dull light buff, and usually producing a noticeable wash from shoulders backward, particularly near edge of membranes; underparts not essentially different from back; muzzle, cheeks, ears, and wings blackish.

Skull and teeth.—The skull does not differ appreciably in form from that of *N. noctula*, though it is perhaps slightly narrower and deeper, and the surface is more smoothly rounded off; lambdoid crest slightly developed. Teeth essentially as in the larger species, but transverse diameter of m^3 relatively greater, crown area of upper incisors nearly equal, and lower incisor row forming a more abrupt convexity.

Measurements.—Type (adult male, St. Michael): head and body, 54; tail, 42; tibia, 17; foot, 7·7; forearm, 37; thumb, 6; third finger, 62; fifth finger, 43·7; ear from meatus, 12. Adult male from Terceira: head and body, 50; tail, 43; tibia, 16·6; foot, 7; forearm, 42; thumb, 6; third finger, 72; fifth finger, 48; ear from meatus, 12; width of ear, 11. For cranial measurements see Table, p. 255.

Specimens examined.—Seventeen, from the following localities in the Azores:—Terceira, 4 (B.M. and U.S.N.M.); above Magdalena, Pico, 5; St. Michael, 6 (B.M. and U.S.N.M.); St. George, 2.

Remarks.—The Azorean *Nyctalus* is slightly more differentiated from *N. leisleri* than the Continental forms are among themselves, since it differs from the other members of the genus rather noticeably in colour as well as in size. The specimens show considerable variation in the extent of the light wash on upper parts caused by the pale tips to the longer hairs, but this appears to be independent of locality.

♂ al.	St. Michael, Azores.	F. Du Cane Godman (C & P).	65. 10. 2. 1. (*Type* of species.)
2 ♂, 2 ♀.	St. Michael. (*W. R. O. Grant.*)	Hon. W. Rothschild (P).	3. 6. 5. 1–3, 7.

CRANIAL MEASUREMENTS OF *NYCTALUS LEISLERI* AND *N. AZOREUM*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case at middle.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations
N. leisleri.												
Ireland: Co. Wicklow	90. 2. 14. 1	♂	15·6	11·0	5·0	7·0	8·2	5·2	12·0	6·0	6·2	Teeth slightly worn.
Co. Armagh	74. 5. 28. 9		15·2	10·4	5·0	7·0	8·4	5·0	11·6	6·0	6·2	,, not worn.
,,	98. 11. 12. 5	♀	16·0	10·6	5·0	7·0	8·6	5·2	12·0	6·0	6·2	,, slightly worn.
Belfast	1. 3. 15. 1	♀	15·2	10·2	4·8	6·6	8·4	5·2	11·0	5·8	6·0	,, not worn.
England: Welford, Warwick	7. 1. 1. 386		15·4	10·0	5·0	6·6	8·4	5·2	11·8	6·0	6·0	,, ,,
Cleeve Priory	7. 1. 1. 388	♂	15·6	10·0	4·8	6·8	8·4	5·2	11·4	6·0	6·2	,, slightly worn.
Switzerland: Meiringen, Bern	7. 1. 1. 389		15·0	—	5·0	6·4	8·4	5·4	11·2	5·8	6·0	,, not worn.
N. azoreum.												
Azores: Terceira	6. 3. 5. 4	♂	14·0	9·2	4·8	6·4	8·4	5·0	10·2	5·2	5·8	,, not worn.
,,	6. 3. 5. 5	♀	13·8	9·2	4·4	6·2	7·8	5·0	10·2	5·4	5·8	,, slightly worn.
,,	6. 3. 5. 6	♀	14·0	9·2	4·6	6·2	8·0	5·0	10·2	5·2	5·6	,, ,,
,,	60645	♀	14·2	9·6	4·6	6·0	8·0	5·0	10·2	5·2	5·6	,, ,,
San Jorge	3. 6. 5. 8	♂	13·0	9·0	4·6	5·8	8·0	5·0	10·0	5·0	5·4	,, not worn.
,,	3. 6. 5. 9	♀	14·0	9·6	4·6	6·0	8·0	5·0	10·4	5·2	5·4	,, slightly worn.
Pico	3. 6. 5. 10	♂	13·8	9·4	4·8	6·2	8·0	5·0	10·4	5·0	5·4	,, ,,
,,	3. 6. 5. 12	♀	14·2	9·8	4·6	6·4	8·0	5·2	10·6	5·2	5·4	,, not worn.
,,	3. 6. 5. 13	♀	14·0	9·2	4·6	5·8	8·0	5·2	10·0	5·2	5·6	,, ,,
,,	3. 6. 5. 14	♀	13·8	—	4·6	6·0	7·8	5·0	10·2	5·2	5·4	,, ,,
St. Michael	65. 10. 2. 1*	♂	14·0	9·0	4·6	6·4	8·0	5·0	10·0	5·2	5·6	,, slightly worn.
,,	3. 6. 5. 2	♂	13·8	9·8	4·8	6·2	8·0	5·0	10·4	5·2	5·4	,, ,,
,,	3. 6. 5. 3	♂	13·8	9·6	4·6	6·2	8·0	5·2	10·0	5·0	5·6	,, moderately worn.
,,	122490	♂	14·2	9·2	4·6	6·0	7·8	5·2	10·2	5·2	5·6	,, ,,

* Type.

♂, 2 ♀.	Reguinho, Terceira. (*W. R. O. Grant.*)	Hon. W. Rothschild (P).	3. 6. 5. 4–6.
2 ♂, 3 ♀.	Magdalena, Pico. (*W. R. O. Grant.*)	Hon. W. Rothschild (P).	3. 6. 5. 10–14.
♂, ♀.	Calheto, St. George. (*W. R. O. Grant.*)	Hon. W. Rothschild (P).	3. 6. 5. 8–9.

Genus **PLECOTUS** Geoffroy.

1816. ? *Macrotus* Leach, Catal. Spec. Indig. Mamm. and Birds Brit. Mus. (Willoughby Society reprint, 1882), p. 1. Nomen nudum: "European Longear, *Macrotus europæus*."

1818. *Plecotus* Geoffroy, Description de l'Égypte, II, p. 112. For date see Sherborn. Proc. Zool. Soc. London, 1897, p. 288.

1857. *Plecotus* Blasius, Säugethiere Deutschlands, p. 38.

1878. *Plecotus* Dobson, Catal. Chiropt. Brit. Mus., p. 177 (part).

1907. *Plecotus* Miller, Families and Genera of Bats, p. 224, June 29, 1907.

Type species.—*Vespertilio auritus* Linnæus.

Geographical distribution.—Temperate Europe, Asia and northern Africa.

Characters.—Dental formula: $i\frac{2\,2}{3\,3}$, $c\frac{1\,1}{1\,1}$, $pm\frac{2\,2}{3\,3}$, $m\frac{3\,3}{3\,3} = 36$. Skull with large, elongate and rounded brain-case, and slender but normally formed rostrum; auditory bullæ larger than in any other European member of the family, their greatest diameter equal to about three times the distance between them. Ears very large, much longer than head, joined across forehead; nostrils opening upward, their orifices continued backward by slit-like prolongations, the wart-like outgrowths on muzzle not specially prominent.

Remarks.—The genus *Plecotus* is at once recognizable among European bats by the very large ears, joined across forehead. In the only other European genus with 36 teeth (*Miniopterus*) the ears are unusually short. Seven species are known, one of which occurs in Europe.

PLECOTUS AURITUS Linnæus.

1758. *Vespertilio auritus* Linnæus, Syst. Nat., I, 10th ed., p. 32 (Sweden).

1816. ? *Macrotus europæus* Leach, Catal. Spec. Indig. Mamm. and Birds Brit. Mus. (Willoughby Society reprint, 1882), p. 1. Nomen nudum: "European Longear, *Macrotus europæus*."

1818. *Plecotus auritus* Geoffrey, Description de l'Égypte, II, p. 118.

1825. *Vespertilio otus* Boie, Isis, p. 1206 (Copenhagen, Denmark).

1826. *Vespertilio cornutus* Faber, Isis, p. 515 (Jutland, Denmark).

1827. *Plecotus communis* Lesson, Man. de Mammal., p. 95 (France).

1828. *P[lecotus] brevimanus* Jenyns, Trans. Linn. Soc., London, XVI, p. 55 (Grunty Fen, Isle of Ely, Cambridgeshire, England).

1829. *Plecotus vulgaris* Desmarest, Faune Française, p. 18 (France).

1829. [*Vespertilio auritus*] γ *austriacus* Fischer, Synops. Mamm., p. 117. Based on the "second variety" of Desmarest, Dict. des Sci. Nat., LVIII, p. 51, 1829 (Vienna, Austria).

1832. *Plecotus velatus* I. Geoffroy, Guérin's Mag. de Zool., II, Cl. I, pl. 2, p. 5 (not numbered), footnote (Name applied by *lapsus calami* to the common *Plecotus* of England).

1840. *Plecotus megalotos* Schinz, Europ. Fauna, I, p. 19 (Synonym of *auritus;* Brehm cited as authority).

1857. *Plecotus auritus* Blasius, Säugethiere Deutschlands, p. 39.

1860. *Plecotus kirschbaumii* Koch, Achter Ber. Oberhess. Gesellsch. Natur.- u. Heilkunde, Giessen, p. 40, May, 1860 (Dillenburg, Oberhessen, Germany).

1863. [*Plecotus auritus*] var. *typus* Koch, Jahrb. des Vereins für Naturkunde im Herzogthum Nassau, XVIII, p. 406 (Wiesbaden, Nassau, Germany).

1863. [*Plecotus auritus*] var. *montanus* Koch, Jahrb. des Vereins für Naturkunde im Herzogthum Nassau, XVIII, p. 406 (Westerwald, Nassau, Germany).

1863. [*Plecotus auritus*] var. *brevipes* Koch, Jahrb. des Vereins für Naturkunde im Herzogthum Nassau, XVIII, p. 407 (Substitute for *kirschbaumii* Koch).

1878. *Plecotus auritus* Dobson, Catal. Chiropt. Brit. Mus., p. 178.

1910. *Plecotus auritus* Trouessart, Faune Mamm. d'Europe, p. 12.

Type locality.— Sweden.

Geographical distribution.—From Ireland eastward into Asia, and from the Mediterranean north to the Scandinavian Peninsula.

Diagnosis.—Characters as in the genus; auditory bullæ not excessively enlarged; forearm about 37 mm.

External characters.—General form slender and delicate, the most conspicuous feature the greatly enlarged ears, the superficial area of which together when outstretched is considerably greater than that of entire body. Muzzle rather narrow, its width at middle about equal to distance from tip to point on forehead at middle of base of joining membrane of ears; glandular swellings not conspicuous, but extending up over sides to median line behind nostrils, and backward to eye. Nostrils opening upward and slightly forward, their orifices crescentic with slit-like posterior elongation; space between nostrils flat, crossed at middle by a transverse groove with overhanging anterior edge. Lips moderately full, smooth. Ear very large, extending about 20 mm. beyond tip of muzzle when laid forward, its length from meatus nearly equal to that of forearm: general outline of conch a simple, rater elongate oval, the anterior and posterior borders evenly convex, the tip rather narrowly rounded; anterior bases joined across forehead, the membrane at point of junction about 2·5 mm. high; outline of anterior border broken about 3 mm. above base by conspicuously projecting, evenly rounded lobe 2 mm. long by 3 mm. wide at base; antitragus scarcely indicated, the posterior border of conch terminating abruptly a little behind level of eye; inner surface of conch with about twenty faint cross striations; joining membrane thinly furred; a hairy line

parallel with anterior border, and minute scattered tufts on other parts of inner surface ; tragus simple, erect, about half as high as conch, the anterior border straight below, slightly convex above, the tip narrowly rounded, the posterior border faintly concave above, distinctly convex below, greatest width (through anterior base) equal to a little less than half length of anterior border ; posterior basal lobe well developed though not large. Wing broad, the fifth finger exceeding forearm by more than one-third length of latter, the membrane thin and semi-transparent, joining foot at base of outer toe ; third and fourth metacarpals equal, about 2 mm. shorter than forearm, fifth slightly shorter than fourth ; leg slender ; foot about half tibia ; calcar slender but sharply defined, equal in length to tibia and to free border of interfemoral membrane, its distal termination marked by a slight lobe, its keel obsolete. Tail extending about to point of juncture of ears when laid forward, the extreme tip (about 1·5 mm.) free.

Skull.—Among the European members of the order the skull of *Plecotus* is noticeable for its large, rather low, smoothly rounded brain-case, relatively small, weak rostrum, and much inflated auditory bullæ. Dorsal profile rising gradually from front of nares to middle of anterior portion of brain-case, with slight concavity at interlachrymal region, then falling gradually to low, strongly convex, slightly overhanging lambda : ventral profile scarcely elevated posteriorly. Brain-case large but rather low, the depth at middle only a little more than half mastoid breadth, the general outline when viewed from above squarish with rounded occipital projection and abrupt anterior constriction, the surface smoothly rounded, with slightly indicated sagittal ridge anteriorly and very low, short lambdoid crest, the latter situated unusually close to upper edge of foramen magnum ; an irregular area in supramastoid region thickly sprinkled with small vacuities ; base of brain-case smooth, without special features, a narrow groove at each side of basioccipital ; auditory bulla relatively larger than in any other European bat, its diameter about three times the space between bullæ. Interorbital constriction narrow, scarcely hour glass shaped, the anterior upper rim of orbit with narrow, slightly projecting edge ; lachrymal region scarcely half as wide as brain-case. Rostrum both narrow and short, the narial emargination, though not unusually large, extending slightly more than half way back to lachrymal level, its general outline oval, sometimes flattened posteriorly ; dorsal surface of rostrum with slight median crease, the sides evenly rounded off ; rostral depth at front of orbit about equal to distance from orbit to

FIG. 45.
Plecotus auritus.
Nat. size.

alveolus of inner incisor ; anteorbital foramen small, close to rim of orbit, its orifice over parastyle of first molar ; lachrymal foramen slightly above and behind it, on inner edge of orbit. Palate rather broad and short, strongly concave both laterally and longitudinally, the anterior emargination small, scarcely extending back to level of middle of canine ; posterior extension of palate squarish, slightly longer than wide, with slightly developed median spine ; mesopterygoid space somewhat wider than deep. Zygoma slightly but evidently expanded at middle. Mandible slender, but noticeably deeper at symphysis than behind tooth-row ; coronoid process moderately high, the upper margin of posterior section of mandible oblique-concave ; angular process rather heavy, scarcely or not expanded at tip.

Teeth.—The teeth are rather small relatively to size of skull. Inner upper incisor about half as high as canine, with large secondary cusp slightly above middle of shaft, the outline of crown oval, its long axis in line of tooth-row ; outer upper incisor about half as high as inner, its apex a little below secondary cusp of larger tooth, its secondary cusp well developed, on inner side, the outline of crown ovate, with long axis perpendicular to tooth-row and narrower extremity directed inwards. Lower incisors closely crowded but slightly imbricated, the row broadly U-shaped ; the crown area increases regularly from first to third, by addition to postero-internal portion ; cutting edge obscurely trifid ; i_3 with well developed postero-internal tubercle. Upper canine small, scarcely higher than main cusps of molars, its shaft nearly terete, with slightly developed posterior cutting edge, on each side of which lies an evident groove ; cingulum complete, without cusps. Lower canine small, slightly exceeding molars in height, its shaft concave posteriorly, flattened interiorly, evenly convex antero-externally ; cingulum well developed, forming a prominent antero-internal secondary cusp. Anterior upper premolar perfectly in tooth-row, about as large as outer incisor, though more robust, its crown sub-terete, about one-third that of canine in basal area, its shaft with evident posterior cutting edge ; large premolar with crown area about two-thirds that of first molar, the inner side very narrow and without crushing surface, the antero-internal cusp slender but well developed. Crown area of anterior lower premolar about half that of canine, that of posterior premolar nearly equal to that of canine, that of middle premolar a little more than half that of first ; first sub-terete, second oval with long diameter of crown lying across tooth-row, third squarish with antero-external corner rounded off ; cusp of first about half as high as canine, that of second a little shorter, that of third a little longer ; cingulum well developed but not forming true secondary cusps. Upper molars narrow internally, the protocone with rather short base, the hypocone absent or barely indicated ; metacone decidedly higher than paracone ; styles and commissures well developed, though mesostyle of m^2

does not extend outward to level of parastyle and metastyle; W-pattern normal; m^3 with three cusps and three commissures, its crown area about half that of m^2, its transverse diameter through metacone about half length of anterior border. Lower molars with no special peculiarities except that protoconids and inner cusps are unusually high and slender; cingulum forming a barely indicated postero-internal cusp behind entoconid; second triangle of m_3 much narrower than first, but about equal to it in area.

Measurements. — Adult female from Chelmsford, Essex, England: head and body, 42; tail, 45; tibia, 17; foot, 9·6; **forearm**, 39; thumb, 7; third finger, 69; fifth finger, 52; ear from meatus, 36; width of ear, 23; tragus, 19. Two adult males from Silos, Burgos, Spain: head and body, 50 and 51; tail, 46 and 46; tibia, 18 and 17; foot, 8 and 8·4; **forearm**, 41 and 38; thumb, 7·2 and 7·4; third finger, 72 and 70; fifth finger, 57 and 53; ear from meatus, 35 and 37; width of ear, 26 and 26·4; tragus, 17 and 18. Adult female from La Granja, Segovia, Spain: head and body, 45; tail, 44; tibia, 20; foot, 9; **forearm**, 40; thumb, 9; third finger, 72; fifth finger, 53; ear from meatus, 37·4; width of ear, 23; tragus, 17·6. Adult female from Florence, Italy: head and body, 49; tail, 48; tibia, 19·2; foot, 9; **forearm**, 39·4; thumb, 7·8; third finger, 69; fifth finger, 54; ear from meatus, 34; width of ear, 23·4; tragus, 17. For cranial measurements see Table, p. 262.

Specimens examined.—Eighty, from the following localities:—

Scotland: Montrose, Forfar, 4.

Ireland: Antrim, 1; Co. Longford, 2.

England: Alderley, Cheshire, 1; Bowdon, Cheshire, 1; Diss, Norfolk, 1; Winfarthing, Norfolk, 1; Woburn Sands, Bedfordshire, 1; Pembrokeshire, no exact locality, 1; Chelmsford, Essex, 1 (U.S.N.M.); Tring, Hertfordshire, 1; Boxmore, Hertfordshire, 1; Hoddesdon, Hertfordshire, 1; London, 4; Godalming, Surrey, 1; Surrey, no exact locality, 1; Bonchurch, Isle of Wight, 1; near Honiton, Devonshire, 2; Devonshire, no exact locality, 8; no exact locality, 1.

Holland: Oosterbeek, Guelderland, 4.

France: Near Barcelonnette, Basses-Alpes, 1 (Mottaz).

Germany: Wernigerode, 3; Ummerstadt, Thüringen, 2; Magdeburg, 2; Niesky, Silesia, 4; Damsdorf, Silesia, 1.

Austria-Hungary: Csallóköz-Somorja, Pressburg, 7.

Switzerland: Geneva, 2 (Mottaz); Lausanne, Vaud, 1 (Mottaz); Morat, Fribourg, 1 (Mottaz); Boudry, Neuchatel, 2 (Mottaz); Teufen, Appenzell, 1 (U.S.N.M.); Thurgau, St. Gallen, 1; St. Gothard, Uri, 3 (U.S.N.M.); no exact locality, 1.

Italy: Borzoli, near Genoa, 1 (Genoa); Florence, 1 (Mottaz); Rimini, 1; Rome, 1; no exact locality, 1; Sicily, 1.

Spain: Silos, Burgos, 2 (U.S.N.M.); La Granja, Segovia, 1.

Remarks.—*Plecotus auritus* is so readily distinguished from all other European bats by the great size of the ears that no special comparisons are required.

♂, 3 ♀.	Montrose, Scotland.	J. H. Coward (C & P).	11. 1. 3. 48–51
♂ st.	Antrim, Ireland.	Hon. N. C. Rothschild (P).	1. 9. 3. 5.

2 ♂ al.	Longford.	Dr. G. E. Dobson (C & P).	76. 2. 12. 2.
♂.	Pembroke, Wales.	W. E. de Winton (C & P).	11. 1. 3. 393.
1 st.	Winfarthing, Norfolk, England.	E. Markham (C & P).	96. 7. 27. 3.
♂.	Diss, Norfolk. (*W. R. Sherrin.*)	C. H. B. Grant (P).	11. 1. 3. 394.
1 al.	Woburn Sands, Bedfordshire.	A. Death (C & P).	7. 9. 2. 1.
♀.	Boxmore, Hertfordshire.	H. Piffard (C & P).	11. 1. 3. 55.
1 st.	Hoddesdon, Hertfordshire.	A. Chittenden (C & P).	86. 9. 27. 1.
♂.	Tring, Hertfordshire.	Dr. E. Hartert (C & P).	11. 1. 3. 56.
♀ al.	London.	No history.	
♂.	London.	Sergt. Brown (C & P).	11. 1. 3. 57.
♂.	S. Kensington, Middlesex.	——	11. 1. 3. 54.
♂.	Godalming, Surrey.	W. T. Blanford (C & P).	11. 1. 3. 58.
1.	Bonchurch, Isle of Wight.	Rev. C. A. Bury (C & P).	41. 3. 29. 6.
♂, ♀.	Honiton, Devonshire, 300 ft.	G. C. Shortridge (C & P).	11. 1. 3. 52–53.
4 ♂, 4 ♀ al.	Devonshire.	No history.	
2 ♂, 2 ♀.	Oosterbeek, Guelderland, Holland.	O. Thomas (C & P).	98. 2. 1. 1–4.
♀.	Wernigerode, Harz, Germany.	W. Wolterstorff (C & P).	0. 2. 8. 1.
♂, ♀.	Wernigerode, Harz. (*Wolterstorff.*)	Lord Lilford (P).	11. 1. 1. 45–46.
♂.	Magdeburg, Saxony. (*Wolterstorff.*)	Lord Lilford (P).	11. 1. 1. 47.
♂, ♀.	Ummerstadt, Thüringen. (*Schuchardt.*)	Lord Lilford (P).	11. 1. 1. 43–44.
♂.	Niesky, Silesia. (*W. Baer.*)	Lord Lilford (P).	99. 1. 9. 1.
♂ al.	Damsdorf, Silesia.	Dr. A. Günther (P).	66. 8. 1. 10.
7.	Csallóköz-Somorja, Pressburg, Austria-Hungary.	Budapest Museum (E).	94. 3. 1. 5–11.
♂.	Thurgau, St. Gallen, Switzerland. (*Zollikofer.*)	O. Thomas (P).	4. 4. 5. 14.
1.	Switzerland.	Leon O. Galliard (P).	75. 9. 20. 2.
♀ al.	Rimini, Italy.	Florence Museum (E).	85. 7. 6. 2.
♂.	Rome. (*C. Coli.*)	G. Barrett-Hamilton (P).	11. 1. 2. 15.
Skeleton (without skull).	Italy. (*Prince Bonaparte.*)	Tomes Collection.	7. 1. 1. 728.
♀ al.	Sicily.	Purchased (Parzudaki).	52. 2. 26. 18.
1 al.	La Granja, Segovia, Spain.	M. de la Escalera (C).	8. 7. 30. 5.
1.	Europe.	Leyden Museum (E).	37. 4. 28. 25.

CRANIAL MEASUREMENTS OF *PLECOTUS AURITUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case at middle.	Mandible.	Maxillary tooth-row (exclusive of incisors).	Mandibular tooth-row (exclusive of incisors).	Observations.
England: Essex	152594	♀	15·0	8·0	3·2	4·8	8·0	5·0	9·8	5·0	5·4	Teeth not worn.
Surrey	11. 1. 3. 58	♂	14·0	8 4	3·4	4·8	8·0	5·4	9·8	4·8	5·2	,, slightly worn.
Tring	11. 1. 3. 56	♂	14·8	8·6	3·2	4·8	8·0	5·4	10·0	5·0	5·2	,, not worn.
Boxmore	11. 1. 3. 55	♀	15·0	9·0	3·2	5·0	8·0	5·2	10·2	5·0	5·4	,, ,,
London	11. 1. 3. 57	♂	14·2	8·8	3·2	4·8	8·0	5·4	10·0	5·0	5·4	,, ,,
,,	11. 1. 3. 54	♂	14·4	8·6	3·2	4·8	7·8	5·2	10·0	5·0	5·4	,, ,,
Holland: Oosterbeek, Guelderland	98. 2. 1. 2	♂	15·0	8·8	3·6	5·0	8·0	6·0	10·4	5·2	5·6	,, ,,
,, ,,	98. 2. 1. 3	♀	14·6	8·4	3·6	5·0	8·0	5·6	10·2	5·2	5·6	,, ,,
Germany: Wernigerode	152596	♂	15·0	8·6	3·6	5·0	8·0	5·4	10·4	5·4	6·0	,, ,,
,,	11. 1. 1. 45	♂	15·2	8·8	3·6	5·0	8·4	5·8	10·4	5·2	5·6	,, ,,
,,	11. 1. 1. 46	♀	15·4	9·0	3·4	5·4	8·4	5·4	11·0	5·2	5·8	,, moderately worn.
Ummerstadt	11. 1. 1. 43	♂	16·0	8·4	3·6	5·4	8·0	6·0	11·0	5·8	6·0	,, not worn.
,,	11. 1. 1. 44	♂	15·0	—	3·2	5·2	8·2	—	10·4	5·2	5·8	,, ,,
Magdeburg	11. 1. 1. 47	♂	15·4	9·0	3·4	5·0	8·4	6·0	10·8	5·4	6·0	,, ,,
,,	152595	♀	15·2	8·8	3·6	5·0	8·0	5·4	10·6	5·4	5·8	,, moderately worn.
Niesky, Silesia	97. 12. 4. 3	♀	15·2	8·6	3·6	5·2	8·0	5·6	10·0	5·4	5·8	,, not worn.
,, ,,	97. 12. 4. 4	♂	15·0	8·6	3·8	5·4	8·0	5 8	10·0	5·0	5·6	,, ,,
Switzerland: Lausanne, Vaud	1284 Mottaz	♀	16·2	9·0	3·4	5·0	8·0	5·4	11·4	5·8	6·4	,, slightly worn.
Boudry, Neuchatel	2520 ,,	♂	15·4	8·8	3·2	5·0	7·8	5·4	11·0	5·4	5·8	,, not worn.
,, ,,	2521 ,,	♂	15·4	—	3·4	5·0	8·0	5 2	10·6	5·2	5·8	,, ,,
Teufen, Appenzell	123627	♂	15·2	8·2	3·2	5·0	7·8	5·2	10·2	5·2	5·6	,, ,,
Italy: Florence	Mo. 126 Mottaz	♀	15·6	8·8	3·6	5·0	8·4	6·0	10·8	5·6	5·8	,, ,,
Borzoli, Genoa	Genoa	♂	16·2	9·0	3·6	5·2	8·4	5·8	11·0	5·8	6·2	,, ,,

Genus **BARBASTELLA** Gray.

1821. *Barbastella* Gray, London Med. Repos., xv, p. 300, April 1, 1821.
1825. *Barbastellus* Gray, Zool. Journ., ii, p. 243, July, 1825.
1839. *Synotus* Keyserling and Blasius, Wiegmann's Archiv für Naturgesch., 1839, i, p. 305.
1857. *Synotus* Blasius, Säugethiere Deutschlands, p. 42.
1878. *Synotus* Dobson, Catal. Chiropt. Brit. Mus., p. 175.
1897. *Barbastella* Miller, Ann. and Mag. Nat. Hist., 6th ser., xx, p. 375, October, 1897.
1907. *Barbastella* Miller, Families and Genera of Bats, p. 223, June 29, 1907.

Type species.—*Vespertilio barbastellus* Schreber.

Geographical distribution.—Northern Africa; central and southern Europe; west-central Asia to the Himalayas.

Characters.—Dental formula: $i\,\frac{2\text{-}2}{3\ 3}$, $c\,\frac{1\text{-}1}{1\ 1}$, $pm\,\frac{2\ 2}{2\ 2}$, $m\,\frac{3\ 3}{3\ 3} = 34$. Skull with rather long, rounded brain-case and weak rostrum, the upper surface of which is occupied by a shallow, flattened-concave area extending from nares to faintly developed supraorbital ridges; auditory bullæ not specially enlarged. Ears broad and short (laid forward they reach slightly beyond tip of muzzle), joined across forehead; nostrils opening upward and outward on a flat median space between two high lateral swellings and behind a prominent median pad.

Remarks.—The short broad ears joined together across forehead distinguish this genus from the other European members of the family *Vespertilionidæ*. Two species are known, one peculiar to the Himalayan region, the other occurring in Europe.

BARBASTELLA BARBASTELLUS Schreber.

1774. *Vespertilio barbastellus* Schreber, Säugthiere, i, pl. lv (description, i, p. 168, under name: Das Kurzmaul). Based primarily on "La Barbastelle" of Daubenton, Hist. Acad. Royale des Sci., Paris, 1759, p. 377. 1765.
1776. *Vespertilio barbastelle* P. L. S. Müller, Natursyst. Suppl. u. Regist.-Band, p. 17 (Burgundy).
1836. *Barbastellus daubentonii* Bell, Hist. Brit. Quadr., pt. i, p. 63 (Burgundy; based primarily on Daubenton).
1838. *Barbastellus communis* Gray, Mag. Zool. and Bot., ii, p. 495, February, 1838 (Renaming of *barbastellus*).
1857. *Synotus barbastellus* Blasius, Säugethiere Deutschlands, p. 43.
1878. *Synotus barbastellus* Dobson, Catal. Chiropt. Brit. Mus., p. 176.
1897. *Barbastella barbastellus* Miller, Ann. and Mag. Nat. Hist., 6th ser., xx, p. 385, October, 1897.
1910. *Barbastella barbastellus* Trouessart, Faune Mamm. d'Europe, p. 11.

Type locality.—Burgundy, France.

Geographical distribution.—Central and southern Europe,

west to England, north to southern Norway and Sweden, east into Asia.

Diagnosis.—Characters as in the genus; forearm about 38 to 40 mm.

External characters.—General form slender and delicate, the legs long, the tail about equal to head and body. Muzzle short and broad, its width considerably greater than distance from tip of snout to joining membrane of ears, each side with a very large glandular mass rising above level of flat median dorsal surface and extending downward to involve most of upper lip behind nostril pad; glandular masses densely hairy in noticeable contrast with the finely pubescent nostril pad and essentially naked median region between nostrils and inner bases of ears; nostrils crescentic in outline, opening upward, somewhat crowded between glandular lateral masses; nostril pad well defined, rounded off above, continued downward into median portion of upper lip, the edge of which, between glandular masses and separated from them by evident grooves, is distinctly convex, fitting like a valve, when mouth is closed, over bare median callosity of lower lip. Ear large and broad, though not specially elongated, the tip extending about 5 mm. beyond nostril when laid forward; anterior basal lobe very small, appearing like a rudimentary *Molossine* keel, the portion of anterior border usually reflexed in *Vespertilionine* bats thrown forward so that its base joins its fellow of opposite ear, the region of juncture low but sufficiently well developed to form a distinct pocket on side next forehead; outline of anterior border strongly convex except for an evident flattening just below the rather abruptly rounded off and somewhat recurved tip; posterior border abruptly concave above, then nearly straight except for an abruptly projecting lobe near middle (lobe usually about 1·5 mm. long by 1 mm. wide, its upper border convex, its lower border concave); lower border of ear full and rounded, but with no differentiated antitragus; tragus large, somewhat triangular in outline, its greatest width (slightly above level of anterior base) equal to about two-thirds length of anterior border, its upper portion rapidly narrowing to an attenuate tip; meatus with well developed keel-like ridge; outer surface of ear densely furred except at extreme tip and along posterior border to a little below level of projecting lobe; inner surface with a hairy line marking juncture of anterior border of conch with portion usually folded backward, elsewhere irregularly sprinkled with fine hairs. Membranes thin and delicate, the wing broad, inserted at base of outer toe, the antebrachial membrane continued outward as a very narrow fold to base of thumb; third metacarpal slightly shorter than forearm and a little exceeding the sub-equal fourth and fifth; fur soft and loose, the hairs on middle of back about 10 mm. in length; on both upper and under surface of wing the fur extends to a line joining middle of forearm with knee; foot less than half as long as tibia; calcar

about as long as tibia, with small but evident terminal lobe and posterior keel; tail with extreme tip projecting beyond interfemoral membrane.

Colour.—General colour a very dark brown between the seal-brown and vandyke-brown of Ridgway, the hairs everywhere dark brown to extreme base, those of upper parts tipped with light glossy wood-brown producing a sharply contrasted wash throughout region behind shoulders, those of underparts tipped with a paler, more drabby brown, but without producing so decided a contrast as on back, though the wash is usually evident along middle of belly; hairs on base of under side of interfemoral membrane pale ecru-drab or whitish smoke-grey nearly or quite to base. Ears and membranes in dry specimens brown, hardly so dark as ground colour of body.

Skull.—The skull, though lightly-built and small, scarcely exceeding that of *Myotis mystacinus* in length, is rather deep and robust, with unusually large brain-case relatively to the short rostrum. Dorsal profile abruptly convex over anterior half of brain-case, then nearly horizontal to somewhat overhanging occiput; ventral profile nearly horizontal, the floor of brain-case scarcely elevated above level of tooth-row. Brain-case high and inflated anteriorly, relatively low posteriorly, its lateral outlines when viewed from above essentially as in the species of *Myotis*, but less rounded and globular posteriorly; floor of brain-case with no special peculiarities; auditory bullæ scarcely more inflated than in the small species of *Myotis*. Interorbital region slightly constricted, its surface flattened and not well defined from that of rostrum; lachrymal ridges rather prominent, especially at their lower extremities. Zygoma nearly straight, scarcely bowed outward beyond level of outer surface of brain-case. Anteorbital foramen relatively large, over anterior margin of m^1. Rostrum short, its upper surface flattened-concave, deeply emarginate in front by the unusual backward extension of the upper margin of anterior nares, the posterior border of which is at level of anteorbital foramina, exposing anterior extremity of vomer. Palate short, noticeably concave both longitudinally and laterally; its anterior emargination small, extending slightly behind level of middle of canine; its posterior border slightly behind level of m^3, double emarginate with short median projection; mesopterygoid space slightly wider than long. Mandible slender, with no special peculiarities.

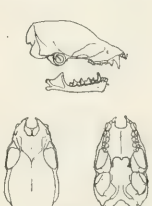

FIG. 46.

Barbastella barbastellus. Nat. size.

Teeth.—In general aspect the teeth resemble those of *Plecotus auritus*, though they are throughout smaller and more slender. Incisors both above and below essentially as in *Plecotus auritus* except that crown of outer upper incisor is nearly terete, and

space between it and cingulum of canine is very narrow ; lower incisors forming a less broadly U-shaped row. Canines as in *P. auritus*. Anterior upper premolar very minute, crowded inward completely from tooth-row, the diameter of its crown barely one-quarter that of outer incisor, its cusp and cingulum distinct ; large upper premolar much as in *P. auritus* but less narrowed on inner side and with a narrow concave crushing surface ; no antero-internal basal cusp. Lower premolars almost exactly similar to middle and posterior lower premolar of *Plecotus auritus*, but crown area of larger tooth slightly exceeding that of canine. Molars not appreciably different from those of *Plecotus auritus* except that they are smaller and the concave median region of the upper teeth is larger relatively to area of crowns.

Measurements.—Adult male from Cheshire, England : head and body, 48 ; tail, 49 ; tibia, 19 ; foot, 7·2 ; **forearm,** 38·4 ; thumb, 6 ; third finger, 69 ; fifth finger, 52 ; ear from meatus, 15 ; width of ear, 14. Adult female from Epping, Essex, England : head and body, 49·6 ; tail, 46 ; tibia, 18·2 ; foot, 7 ; **forearm,** 36 ; thumb, 5·8 ; third finger, 69 ; fifth finger, 51 ; ear from meatus, 16 ; width of ear, 14. Average and extremes of five adults from Damsdorf, Silesia, Germany : head and body, 50 (47–52) ; tail, 47·1 (45–49) ; tibia, 18·5 (18–19) ; foot, 6·6 (6–7) ; **forearm,** 38 (37·4–39) ; thumb, 5·8 (5·4–6·2) ; third finger, 70 (68–72) ; fifth finger, 52·6 (51–54) ; ear from meatus, 15·5 (15–16) ; width of ear, 14·1 (13·6–15). For cranial measurements see Table opposite.

Specimens examined.—Sixty-one, from the following localities :—

England : Elton, Huntingdonshire, 1; Ellingham, Norfolk, 1; Arrow Lodge, Warwickshire, 1; Alcester, Warwickshire, 1; Rugby, Warwickshire, 1; Welford, Rugby, 1; Pilton, Oundle, Northamptonshire, 1; Epping, Essex, 1; Llanelwedd, Radnorshire, 1; Swindon, Wiltshire, 1; Milton, Hampshire, 1.

France : Caterille, Haute-Garonne, 1.

Germany : Büchenberg, Harz Mountains, 1; Niesky, Silesia, 4; Bavaria, no exact locality, 3 (U.S.N.M.) ; near Wernigerode, Saxony, 1.

Switzerland : Grotte de Vallorbe, Vaud, 40 (Mottaz).

Remarks.—This species is immediately recognizable among European bats by its short, joined ears, and by the peculiar form of the muzzle.

♀.	Llanelwedd, Radnorshire, Wales.	H. E. Forrest (c & p).	4. 7. 3. 1.
♀.	Elton, Huntingdonshire, England.	Lord Lilford (p).	94. 9. 5. 1.
♂.	Ellingham, Norfolk. (*Dr. W. M. Crowfoot.*)	E. R. Alston (p).	81. 6. 9. 1.
♂.	Arrow Lodge, Warwickshire.	Tomes Collection.	7. 1. 1. 348.
1.	Alcester, Warwickshire.	Tomes Collection.	7. 1. 1. 348.
♂ st.	Rugby, Warwickshire.	G. Dalgleish (c & p).	4. 10. 13. 2.
♂.	Oundle, Northamptonshire.	Lord Lilford (c & p).	94. 4. 16. 1.
♀ al.	Epping, Essex.	H. Doubleday (c & p).	44. 5. 1. 1.
♂.	Milton, Hampshire.	Rev. J. E. Kelsall (p).	11. 1. 3. 59.

CRANIAL MEASUREMENTS OF *BARBASTELLA BARBASTELLUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case at middle.	Mandible.	Mandibular tooth-row (exclusive of incisors).	Maxillary tooth-row (exclusive of incisors).	Observations.
England: Welford, Rugby . .	4. 10. 13. 2	♂	13·6	7·4±	3·6	5·0	7·4	—	9·0	4·8	5·2	Teeth slightly worn.
France: Caterille, Haute-Garonne	6. 4. 1. 7	♂	13·4	7·4	3·8	5·0	7·4	5·0	9·2	4·6	5·0	,, not worn.
Germany: Wernigerode, Saxony.	0. 2. 8. 2	♂	13·4	7·4	3·4	4·8	7·0	5·0	9·0	4·6	5·2	,, ,,
Niesky, Silesia .	97. 12. 4. 1	♂	13·2	7·2	3·6	5·0	7·6	5·2	9·0	4·6	5·0	,, ,,
,, ,, .	97. 12. 4. 2	♂	13·0	7·4	3·8	5·0	7·4	5·0	9·2	4·8	5·0	,, slightly worn.
,, ,, .	97. 12. 4. 3	♀	13·4	7·4	3·8	5·0	7·4	5·0	9·4	4·6	5·0	,, not worn.
,, ,, .	99. 1. 9. 2	♀	13·4	7·6	3·4	4·8	7·4	5·0	9·2	4·6	5·0	,, ,,
Switzerland: Grotte de Vallorbe, Vaud . . .	142583	♂	13·2	7·6	3·6	5·0	7·0	5·2	9·0	4·8	5·2	,, ,,
,, ,,	1281 Mottaz	♂	13·6	7·6	3·6	4·6	7·0	—	9·2	4·6	5·0	,, ,,
,, ,,	1375 ,,	♂	13·6	7·6	3·6	4·8	7·2	5·2	9·2	4·8	5·0	,, ,,
,, ,,	2503 ,,	♀	13·6	7·6	3·6	4·8	7·2	5·0	9·2	4·6	5·0	,, ,,
,, ,,	2422 ,,	♀	13·6	7·6	3·6	5·0	7·2	5·0	9·0	4·8	5·0	,, ,,

♂.	Swindon, Wiltshire.	Rev. E. A. Goddard (C & P).	8. 5. 12. 1.
♂.	Caterille, Haute-Garonne, 1000 m. France. (*A. Robert.*)	O. Thomas (P).	6. 4. 1. 7.
♂, ♀.	Niesky, Silesia, 181 m. Germany. (*W. Baer.*)	Dr. E. Hamilton (P).	97. 12. 4. 2–3.
2 ♀.	Niesky, Silesia. (*W. Baer.*)	Lord Lilford (P).	99. 1. 9. 2, 4.
♂.	Wernigerode, Saxony. (*Wolterstorff.*)	Lord Lilford (P).	0. 2. 8. 2.

Sub-Family MINIOPTERINÆ.

1878. *Miniopteri* Dobson, Catal. Chiropt. Brit. Mus., p. 170 (part).
1907. *Miniopterinæ* Miller, Families and Genera of Bats, p. 227, June 29, 1907.

Geographical distribution.—Africa, southern Europe and southern Asia, eastward to the Malay region, Japan and Australia.

Characters.—Like the *Vespertilioninæ*, but presternum with median lobe enormously developed and forming the greater part of the bone; scapula with coracoid straight, directed conspicuously inward.

Remarks.—The sub-family *Miniopterinæ*, though widely distributed in the warmer portions of the Old World, is at present known to contain the genus *Miniopterus* only.

Genus **MINIOPTERUS** Bonaparte.

1837. *Miniopterus* Bonaparte, Iconogr. Faun. Ital., I, fasc. XX, under *Vespertilio emarginatus* (Sub-genus of *Vespertilio*).
1857. *Miniopterus* Blasius, Säugethiere Deutschlands, p. 45.
1866. *Miniopteris* Gray, Ann. and Mag. Nat. Hist., 3rd ser., XVII, p. 91, February, 1866.
1878. *Miniopterus* Dobson, Catal. Chiropt. Brit. Mus., p. 347.
1892. *Minyopterus* Winge, Jordfundne og nulevende Flagermus (Chiroptera) fra Lagoa Santa, Minas Geraes, Brasilien, p. 36.
1900. *Minneopterus* Lampe, Jahrb. Nassau Ver. Naturkunde, Jahrg. 53, Catal. Säugeth.-Samml., p. 12.
1907. *Miniopterus* Miller, Families and Genera of Bats, p. 227, June 29, 1907.

Type species.—*Vespertilio ursinii* Bonaparte = *V. schreibersii* Kuhl.

Geographical distribution.—Same as that of the sub-family.

Characters.—Dental formula: $i\frac{2}{3}$, $c\frac{1}{1}$, $pm\frac{2}{3}$, $m\frac{3}{3} = 34$. Skull with unusually high brain-case, and low, flattened rostrum. Second phalanx of third finger nearly three times as long as first. Ears short, separate, the upper margin (in European species) appearing almost artificially truncate.

Remarks.—The peculiar shortening of the ears together with the remarkable elongation of second phalanx of third finger readily

distinguish this genus among the members of the European fauna. About a dozen forms have been described, one of which occurs in southern Europe.

MINIOPTERUS SCHREIBERSII Kuhl.

1819. *Vespertilio schreibersii* Kuhl, Ann. Wetterau. Gesellsch. Naturk., IV (= Neue Ann., I), pt. 2, p. 185 (Hungary).
1837. *Vespertilio ursinii* Bonaparte, Iconogr. Faun. Ital., I, fasc. XXI (Monte Corno, Ascoli, Italy). Type in British Museum.
1841. *Vespertilio orsinii* Temminck, Monogr. de Mamm., II, p. 179 (modification of *ursinii*).
1857. *Miniopterus schreibersii* Blasius, Säugethiere Deutschlands, p. 46.
1878. *Miniopterus schreibersii* Dobson, Catal. Chiropt. Brit. Mus., p. 348.
1910. *Miniopterus schreibersi* Trouessart, Faune Mamm. d'Europe, p. 34.

Type locality.—Kulmbazer Cave, mountains of southern Bannat, Hungary.

Geographical distribution.—Southern Europe from the Iberian Peninsula eastward, north to Switzerland and Hungary. Limits of range not known.

Diagnosis.—Charaters as in the genus; forearm about 43 mm.

External characters.—General form rather slender, with long tail and legs, wing broad at base but conspicuously tapering at tip, and short ears with a peculiar truncate aspect. Muzzle rather broad, though without conspicuous glandular swellings, its greatest width about equal to distance from eye to nostril; muzzle pad narrow, with slight median emargination, bounded below by a low horizontal ridge which is continuous with projecting inner margin of nostril. Eyelids noticeably glandular-swollen; a deep horizontal groove in cheek below eye. Ear short, extending about half way from eye to nostril when laid forward, its general aspect different from that of any other European bat, owing to the length of the anterior basal lobe, the short, straight anterior border, and the broadly, evenly convex posterior border which joins anterior border in such a manner that there is practically no "tip," the whole anterior border appearing like an obliquely, almost artificially truncate extremity; antitragus low, obscurely marked off from posterior border of conch, practically continuous with lower lip anteriorly; inner surface of conch slightly rugose, without evident cross ridges; tragus about half as high as conch, a little curved forward owing to slight concavity of anterior border, the blunt tip and upper half of exterior border forming a uniform, rather noticeable convexity, the posterior margin straight below to rudimentary basal lobe; greatest width of tragus about half anterior border. Wing rather wide basally, the fifth finger exceeding forearm by about one-fifth length of latter, the tip unusually slender and elongate owing to the great length of last bone of third finger; third and fourth

metacarpals sub-equal, about 3 mm. shorter than forearm ; fifth metacarpal about 4 mm. shorter than third ; membrane joining leg at or a little above ankle. Leg rather slender, the foot scarcely half as long as tibia ; calcar about as long as tibia and nearly equal to free border of uropatagium, its distal termination very obscure, its posterior border without trace of keel. Tail about as long as head and body, included in the membrane to extreme tip.

Fur and colour.—The fur is of a very soft, silky texture, though rather short, the hairs at middle of back only about 7 mm. in length, those of head abruptly much shorter (about 4 mm.) in rather noticeable contrast. Above it scarcely extends on membranes except for a sparse pubescence on basal half of median portion of uropatagium ; below it reaches line joining middle of forearm with knee and continues across extreme base of uropatagium. General colour of upper parts drab, faintly lighter and more nearly hair-brown anteriorly ; underparts ecru-drab. The hairs of back show three evident though not strongly contrasted colour-bands : (*a*) at base (3 mm.), a slaty mouse-grey ; (*b*) at middle (tips of shorter hairs, 2 mm.), ecru-drab ; and (*c*) at tip (extremities of longer hairs, 2 mm.), drab. Muzzle, ears and membranes brown, scarcely darker than body.

Skull. —The skull differs from that of all other European bats in the great inflation of the anterior portion of brain-case and the consequent very abrupt angle at which the forehead rises above the low, flat rostrum. In other respects the general aspect of skull, especially when viewed from above, is rather slender and lightly built. Dorsal profile rising gradually from front of nares to inter-lachrymal region, then abruptly at an angle of nearly 45° to middle of anterior portion of brain-case which is nearly or quite as high as lambda, the region between these two highest points occupied by a shallow concavity corresponding to anterior edge of interparietal ; below and behind lambda the supraoccipital bulges noticeably outward, but not sufficiently to conceal condyles when skull is viewed from directly above ; ventral profile nearly flat, slightly elevated posteriorly. Brain-case broadly ovate, the outline broken at each side posteriorly by the slightly projecting mastoid region ; sagittal crest low but evident anteriorly, obsolete posteriorly ; lambdoid crest moderately developed at sides, barely indicated at middle ; general outline of skull when viewed from behind squarish, the depth through bulla about equal to breadth of brain-case ; floor of brain-case with no special peculiarities ; between cochlea and median line a shallow groove with abrupt pit-like anterior termination a noticeable ridge

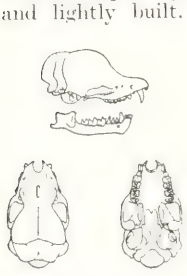

FIG. 47.
Miniopterus schreibersii.
Nat. size.

at outer side of each pit; auditory bulla moderately large, the transverse diameter about equal to distance between bullæ. Interorbital region moderately constricted, slightly hour-glass shaped, the lachrymal region scarcely more than half as wide as brain-case, smoothly rounded at sides; rostrum tapering gradually, rounded off at sides, flattened concave along median line, the narial emargination small, squarish, extending backward about one-third of the distance to front of forehead; rostral depth at front of orbit about equal to distance from orbit to outer incisor; anteorbital foramen rather large, directly above small premolar, the anteorbital canal half as long as rostrum, thus much longer than in any other European bat; lachrymal foramen just outside of orbit, on level with upper border of anteorbital foramen. Palate long and wide, distinctly concave both laterally and longitudinally, terminating rather abruptly a little behind level of last molar, a small but evident foramen at each side near posterior edge; median spine large; mesopterygoid space squarish, slightly wider posteriorly than anteriorly, the short hamulars bent inward. Mandible slender, a little deeper at symphysis than behind tooth-row, the posterior segment unusually small, with nearly horizontal, slightly concave upper border; angular process relatively long, expanded at outer end.

Teeth.—Relatively to size of skull the teeth are small and weak. Inner upper incisor low, the crown very oblique, with postero-external concavity and small postero-internal cusp; outer upper incisor considerably larger than inner, the crown flattened in axis of tooth-row, the width of its flattened-concave posterior surface about half its height, that of its outer border scarcely one-fifth height, cingulum obsolete, but forming a minute postero-external cusp; the two teeth lie in curve of anterior portion of tooth-row, and the outer is separated from canine by a space about equal to its greatest diameter. Lower incisors closely crowded but not imbricated, the crown-area increasing regularly from first to third, the outline of the row as a whole broadly V-shaped; i_1 and i_2 with crown very low, the cutting edge obscurely trifid, the crown of each tooth wider posteriorly (in line of tooth-row) than anteriorly, but this more evident in second than in first; i_3 nearly terete, the middle and posterior cusps enlarged and separated by a deep groove, the anterior cusp reduced to a mere rudiment. Upper canine slender and weak, sub-terete, but distinctly flattened on inner side, the shaft with distinct anterior and posterior longitudinal grooves but without well developed cutting edge, the cingulum narrow, complete, but without cusps; lower canine scarcely higher than main cusps of molars, its inner and posterior surfaces flattened, its antero-external surface smoothly rounded, cingulum forming a low but evident antero-internal cusp. Anterior upper premolar with crown area about equal to that of canine, its general form

essentially as in large premolar except that the antero-internal basal cusp is barely indicated, the cutting edges of the main cusp are less developed, and the crown is narrower externally than internally; large upper premolar with crown area about equal to that of first molar and double that of small premolar, its anterior and posterior borders very slightly concave, the antero-internal basal cusp small but evident, the main cusp with well developed anterior and posterior cutting edges, and antero-internal and postero-external longitudinal groove; lower premolars essentially alike in form, the crown area of the posterior tooth about equal to that of canine, that of the two others successively a little less, the outline squarish, with antero-external angle tending to become rounded off, particularly in the posterior tooth; cusp of first about half as high as canine, that of second slightly higher than first, that of third nearly as high as main cusps of molars; cingulum well developed, forming in each tooth a small but evident antero-internal basal cusp. First and second upper molars with posterior border deeply and almost angularly emarginate near inner edge of tooth, the anterior border nearly straight; protocone low but rather broad; hypocone clearly indicated but not distinct from posterior commissure of protocone; paracone and metacone nearer outer edge of crown than usual, leaving a wide, pit-like median concavity, metacone slightly the higher of the two cusps; styles and commissures well developed, W-pattern normal; third upper molar with crown area about half that of first, its width through metacone slightly less than half length of anterior border, its three cusps and three commissures normally developed. Lower molars with no special peculiarities, the second triangle of m_3 narrower than first, but of about the same area.

Measurements.—Adult male and female from Neuchatel, Switzerland: head and body, 59 and 59; tail, 58 and 60; tibia, 20 and 19; foot, 10 and 9·4; **forearm**, 45 and 44·6; thumb, 7 and 7; third finger, 92 and 92; fifth finger, 53 and 54; ear from meatus, 12·6 and 12; width of ear, 12 and 12. Adult male and female from Corinth, Greece: head and body, 57 and 56; tail, 57 and 55; tibia, 18·6 and 19; foot, 10 and 9·6; **forearm**, 44 and 45; thumb, 6·6 and 7·2; third finger, 92 and 90; fifth finger, 54 and 53; ear from meatus, 12 and 12; width of ear, 12 and 12. Two adult males from Silos, Burgos, Spain: head and body, 60 and 60; tail, 60 and 57; tibia, 19 and 19·4; foot, 11 and 9·6; **forearm**, 44 and 44; thumb, 7·4 and 7·4; third finger, 93 and 89; fifth finger, 55 and 56; ear from meatus, 11·4 and 11·6; width of ear, 13·4 and 12·6. Two adult females from the same locality: head and body, 59 and 59; tail, 60 and 59; tibia, 19·6 and 20; foot, 9·8 and 10; **forearm**, 45·4 and 46; thumb, 8 and 7·4; third finger, 93 and 93; fifth finger, 55 and 55; ear from meatus, 12 and 11·6; width of ear, 12·6 and 12·6. For cranial measurements see Table, p. 274.

Specimens examined.—Three hundred and fifty-one, from the following localities:—

Spain: Silos, Burgos, 9 (B.M. and U.S.N.M.); Seville, 1; Minorca, Balearic Islands, 3; Majorca, Balearic Islands, 2.

France: Troubate, Hautes-Pyrénées, 2; Dions, Gard, 9; Marseilles, 1 (U.S.N.M.).

Switzerland: Geneva, 235 (Mottaz); Neuchatel, 2 (U.S.N.M.).

Austria-Hungary: Ofener Mountains, Hungary, 1; Hungary, no exact locality, 3 (U.S.N.M.).

Montenegro: Beri, 1; Velgi, Czolo, 1.

Italy: Western Liguria, 14 (Genoa); Finalborgo, Liguria, 5 (Genoa); Maremma, Tuscany, 1 (U.S.N.M.); Pisa, 1; Florence, 1 (U.S.N.M.); Livorno, 6 (U.S.N.M.); Spezia, 5 (U.S.N.M.); Monte Corno, Ascoli, 1 (type of *ursinii* Bonaparte); Rome, 10; Velletri, Rome, 2 (U.S.N.M.); no exact locality, 1; Elba Island, 5 (U.S.N.M.); Marsala, Sicily, 2.

Sardinia: Sassari, 3 (U.S.N.M.); Cagliari, 4 (U.S.N.M.); Mount Gennargentu, 2 (U.S.N.M.).

Greece: Corinth, 17 (U.S.N.M.); Labyrinth, Crete, 1.

Remarks.—The lengthened second phalanx of the third finger, the peculiar cropped appearance of the ears, and the short, dense, velvety fur of the head are the most obvious external characteristics of *Miniopterus schreibersii* as compared with other European bats.

2.	Silos, Burgos, Spain.	Rev. S. Gonzalez (c).	88. 1. 5. 46–47.
♂, ♀.	Inca, Majorca, Balearic Islands.	O. Thomas and R. I. Pocock (c & p).	0. 7. 1. 4–5.
3 ♂.	San Cristobal, Minorca.	O. Thomas and R. I. Pocock (c & p).	0. 7. 1. 32–34.
♂, ♀.	Troubate, Hautes-Pyrénées, 400 m. France. (*A. Robert.*)	O. Thomas (p).	6. 4. 1. 8–9.
8 ♂, 1 ♀	Dions, Gard, 70 m. France. (*C. Mottaz.*)	O. Thomas (p).	8. 8. 10. 1–9.
1 al.	Ofener Mountains, Budapest.	Budapest Museum (e).	94. 7. 18. 10.
♀.	Beri, Montenegro. (*L. Führer.*)	O. Thomas (p).	5. 8. 4. 6.
♀.	Velgi, Czolo. (*L. Führer.*)	O. Thomas (p).	5. 8. 4. 5.
7 ♂, 3 ♀.	Rome. (*C. Coli.*)	Lord Lilford (p).	11. 1. 2. 5–14.
Skeleton (without skull).	Monte Corno, Ascoli, Italy.	Tomes Collection. (*Type of Vespertilio ursinii* Bonaparte.)	7. 1. 1. 735.
2 ♂.	Marsala, Sicily. (*A. Robert.*)	O. Thomas (p).	6. 8. 4. 24–25.
♂.	Labyrinth, 200 ft. Crete.	Miss D. Bate (c).	5. 12. 2. 9.

CRANIAL MEASUREMENTS OF *MINIOPTERUS SCHREIBERSII*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case at middle.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
Spain: Silos, Burgos	152610	♂	15·0	9·0	3·8	5·2	8·2	6·2	11·0	6·0	6·4	Teeth slightly worn.
,, ,,	152612	♂	14·8	8·8	3·8	5·2	8·2	6·4	10·8	6·0	6·4	,, ,,
,, ,,	152614	♀	15·0	8·6	3·6	5·2	8·0	6·4	11·0	6·0	6·2	,, ,,
,, ,,	152616	♀	14·8	8·6	3·6	5·2	8·2	6·0	11·0	6·0	6·2	,, ,,
Minorca, Balearic Islands.	0. 7. 1. 4	♂	14·6	8·4	4·0	5·0	8·0	6·2	10·6	6·0	6·2	,, not worn.
,, ,,	0. 7. 1. 5	♀	14·6	8·4	3·8	5·0	8·0	6·4	10·8	6·0	6·2	,, slightly worn.
Majorca ,,	0. 7. 1. 32	♂	14·6	8·2	3·8	5·2	8·0	6·2	10·8	5·8	6·2	,, not worn.
,, ,,	0. 7. 1. 33	♂	14·4	8·4	4·0	5·0	7·8	6·0	10·8	5·8	6·2	,, slightly worn.
,, ,,	0. 7. 1. 34	♂	14·4	8·4	3·8	5·0	8·0	6·2	10·6	5·8	6·2	,, not worn.
France: Troubate, Hautes-Pyrénées.	6. 4. 1. 8	♂	14·8	8·6	3·8	5·2	8·2	6·2	11·0	6·0	6·2	,, ,,
Switzerland: Geneva	1845 Mottaz	♂	14·6	8·6	3·8	5·2	8·2	6·2	11·0	5·8	6·2	,, ,,
,,	1846 ,,	♂	15·0	8·8	3·8	5·2	8·2	6·4	11·0	6·0	6·2	,, ,,
,,	1849 ,,	♂	14·8	8·6	3·8	5·2	8·0	6·6	11·0	6·0	6·2	,, ,,
,,	1850 ,,	♂	14·8	8·6	3·8	5·2	8·2	6·6	11·0	6·0	6·4	,, ,,
,,	1851 ,,	♂	14·6	8·8	3·8	5·0	8·2	6·4	10·8	6·0	6·2	,, ,,

Italy: Rome	11. 1. 2. 7	♂	14·4	8·4	3·6	5·0	8·0	6·2	11·0	5·8	6·2	Teeth not worn.
,,	11. 1. 2. 11.	♂	14·0	—	3·6	5·2	8·2	6·0	10·8	5·8	6·2	,, ,,
,,	11. 1. 2. 12.	♀	14·0	8·2	3·6	5·0	7·8	6·2	10·6	6·0	6·2	,, ,,
,,	11. 1. 2. 13.	♀	14·6	8·4	3·6	5·2	8·0	6·2	10·8	6·0	6·4	,, ,,
,,	11. 1. 2. 14.	♀	14·0	8·2	3·4	5·0	7·8	6·0	10·4	5·6	6·0	,, ,,
Elba Island	105782	♂	14·2	8·2	3·6	5·0	8·0	6·2	10·4	5·8	6·0	,, ,,
,,	105784	♀	14·6	8·4	3·6	5·0	7·8	6·0	11·0	6·0	6·2	,, ,,
Sicily: Marsala	6. 8. 4. 24	♂	14·6	8·4	3·6	5·0	8·0	6·4	10·8	6·0	6·2	,, ,,
,,	6. 8. 4. 25	♂	14·4	8·8	3·6	5·0	8·0	6·2	10·6	5·8	6·2	,, ,,
Sardinia: Cagliari	84742	♂	14·8	8·6	3·8	5·2	8·2	6·6	10·8	5·8	6·4	,, moderately worn.
,,	84744	♂	14·6	8·6	3·6	5·2	8·0	6·0	10·6	6·0	6·2	,, not worn.
,,	84743	♀	14·6	8·4	3·4	5·2	8·0	6·0	10·8	5·8	6·2	,, slightly worn.
,,	84745	♀	14·4	8·4	3·6	5·2	8·0	6·2	10·8	5·8	6·2	,, not worn.
,,	86537	♀	14·8	8·6	3·8	5·2	8·0	6·2	11·0	6·0	6·2	,, slightly worn.
Montenegro	5. 8. 4. 5	♀	14·6	8·6	3·4	5·0	8·0	6·0	10·6	6·0	6·2	,, not worn.
Greece: Corinth	145206	♂	14·6	8·4	3·6	5·0	8·0	6·2	10·6	5·8	6·2	,, ,,
,,	145208	♂	14·6	8·4	3·8	5·2	8·0	6·2	10·8	5·8	6·2	,, ,,
,,	145212	♂	14·2	8·2	3·6	5·0	8·0	6·0	10·4	5·8	6·0	,, ,,
,,	145207	♀	14·0	8·2	3·6	5·0	8·0	6·2	10·4	5·6	6·0	,, ,,
,,	145211	♀	14·4	8·4	3·6	5·0	8·2	6·2	11·0	5·8	6·0	,, ,,
,,	145217	♀	14·6	8·2	3·6	5·0	8·0	6·4	10·6	6·0	6·2	,, ,,
Hungary	62470	♂	14·6	8·4	3·8	5·2	8·0	6·6	10·8	5·8	6·0	,, ,,

Family MOLOSSIDÆ.

1865. *Molossi* Peters, Monatsber. k. preuss. Akad. Wissensch., Berlin, p. 258.
1872. *Molossidæ* Gill, Arrangement of the Families of Mammals, p. 17.
1878. *Emballonuridæ* (part; *Molossinæ*, part, *Molossi*) Dobson, Catal. Chiropt. Brit. Mus., p. 402.
1907. *Molossidæ* Miller, Families and Genera of Bats, p. 241, June 29, 1907.

Geographical distribution.—Warmer parts of both hemispheres; in the Old World north to the Mediterranean region and southern Asia.

Characters.—Essentially like the *Vespertilionidæ* except that the secondary articulation of humerus with scapula is more perfectly developed and the fibula is robust, adding appreciably to strength of leg. Auditory bulla noticeably emarginate on inner side. Tail projecting very conspicuously beyond membrane, a character by which the only European member of the group may be immediately recognized.

Remarks.—The family Molossidæ is widely distributed in the warmer parts of both hemispheres. Eleven genera are now known, one of which is represented in the Mediterranean region of Europe.

Genus **NYCTINOMUS** Geoffroy.

1818. *Nyctinomus* Geoffroy, Descr. de l'Égypte, II, p. 114 (*ægyptiacus*).
1821. *Nyctinoma* Bowdich, Anal. Nat. Class. Mamm., p. 28 (Modification of *Nyctinomus*).
1821. *Nyctinomes* Gray, London Med. Repos., XV, p. 299, April 1, 1821 (Modification of *Nyctinomus*).
1822. *Nyctinomia* Fleming, Philos. of Zool., II, p. 178 (Modification of *Nyctinomus*).
1842. *Mops* Lesson, Nouv. Tabl. Règne Anim., p. 18 (*Mops indicus* Lesson = *Dysopes mops* F. Cuvier).
1878. *Nyctinomus* Dobson, Catal. Chiropt. Brit. Mus., p. 420 (part).
1902. *Nyctinomops* Miller, Proc. Acad. Nat. Sci. Philadelphia, p. 393, September 12, 1902 (*femorosaccus*).
1907. *Nyctinomus* Miller, Families and Genera of Bats, p. 251, June 29, 1907.

Type species. *Nyctinomus ægyptiacus* Geoffroy.

Geographical distribution.—Warmer portions of both hemispheres, north to the southern United States and to the Mediterranean coast of Europe, east to the Philippines and Norfolk Island.

Characters.—Dental formula: $i\frac{1}{2}\frac{1}{2}$ or $\frac{1}{3}\frac{1}{3}$,* $c\frac{1}{1}\frac{1}{1}$, $pm\frac{2}{2}\frac{2}{2}$, $m\frac{3}{3}\frac{3}{3} = 30$ or 32; brain case not unusually flattened, its depth at least half its width; bony palate with a small median anterior emargination extending to behind level of roots of incisors.

Remarks.—As thus defined the genus *Nyctinomus* contains

* In the species occurring in Europe.

about forty species, two-thirds of which are peculiar to the Old World, one of them occurring in the Mediterranean region of Europe.

NYCTINOMUS TENIOTIS Rafinesque.

1814. *Cephalotes teniotis* Rafinesque, Prée. des Découv. Somiol., p. 12 (Sicily).
1825. *Dinops cestoni* Savi, N. Giorn. de' Letterati, Pisa, x, p. 235 (Pisa, Italy).
1840. *Dysopes savii* Schinz, Europ. Fauna, i, p. 5 (Substitute for *cestoni*).
1871. [*Dysopes cestonii*] var. *nigrogriseus* Schneider, Neue Denkschr. Schweiz. Gesellsch. Naturwiss., xxiv, p. 5 (articles separately paged). Basel, Switzerland.
1877. *Nyctinomus cestonii* Dobson, Catal. Chiropt. Brit. Mus., p. 423.
1891. *Nyctinomus tæniotis* Thomas, Proc. Zool. Soc., London, p. 182.
1897. [*Dysopes*] *midas* Schulze, Abh. Ges. Nat. iv, No. 10, p. 23 (Substitute for *cestoni*). Not of Sundevall, 1842.
1910. *Nyctinomus tæniotis* Trouessart, Faune Mamm. d'Europe, p. 36.

Type locality.—Sicily.

Geographical distribution.—Mediterranean region of Europe and northern Africa. Accidental? at Basel, Switzerland.

Diagnosis.—Like the African *Nyctinomus ægyptiacus* but larger, condylobasal length of skull about 23 mm. instead of about 20 mm.; lower incisor 3–3 instead of 2–2; small upper premolar with crown area more than one-half instead of less than one-fifth that of upper incisor. Distinguishable among European bats by the generic characters; forearm about 60 mm.

External characters.—Form heavy and robust, the legs short, the feet large, the wings long and narrow, the membranes thick and leathery, the ears very large, sub-orbicular, joined at their anterior bases; these characters in connection with the thick muscular tail, projecting by at least one-third of its length beyond interfemoral membrane, immediately distinguish the animal from all other European bats. Muzzle projecting rather noticeably beyond upper lip, obliquely truncate; nostril pad well defined, wider than high, the sub-circular nostrils opening forward and slightly outward at its outer margin, its surface with very fine reticulations and a few coarse wrinkles, glabrous except below, where it is sprinkled with fine hairs, this hairy area continuous with the brush-like fringe of recurved blunt hairs along middle of upper lip; upper margin of pad broadly concave at middle, convex laterally over the nostrils, its edge thickly set with small, laterally compressed horny excrescences, about thirty-five in number, the outermost lying a little above level of middle of nostril; a row of about ten similar excrescences crosses middle of pad vertically. Upper lip very large and full, marked by many deep oblique wrinkles, its surface both above and below rather densely hairy. A small wart on chin just behind level of symphysis. Ear very large, sub-orbicular, the margin with no very decided irregularities, though the anterior border usually shows some slight flattening and the posterior border is faintly concave above

and near base: anterior basal margin of ear with a narrow outward-folded hem, the exposed side of which is densely pubescent except at extreme anterior margin, where it is glabrous and set with about six terete wart-like projections, widely and irregularly spaced; posterior basal margin with a shorter, deeper, inwardly-folded lobe just above concavity limiting posterior base of antitragus; keel well developed, not thickened at edge, its height posteriorly equal to about one-third its length, the margin of keel hairy, the line thus begun curving upward and backward under upper margin of conch; antitragus well defined, its height slightly greater than that of keel, its length about twice height, its anterior border with ridge-like continuation forward to corner of mouth; tragus squarish in outline, its posterior border longest and with distinct angle below middle, its anterior border shortest, its upper border almost horizontally truncate; anterior and upper margin of tragus fringed with long loose hairs. Wings longer and narrower than in any other European bat, the membrane inserted on side of tibia just above ankle; antebrachial membrane extending as a narrow fold along forearm to base of thumb; the fur of body extends on both surfaces of wing to line joining middle of humerus with knee, and on to extreme base of uropatagium; otherwise the membranes are essentially naked except for some fine dense pubescence on upper side of propatagium. Thumb short and robust, with moderately developed pad at distal end of metacarpal. Foot broad and robust, more than half as long as tibia, the sole with a low and rounded but evident pad at middle, four small elongated pads in a row at bases of toes, and some smaller, less definite callosities in space between this row and the large median pad. Outer and inner toe thickened, their outer surfaces densely covered with short stiffened hairs with recurved points; sprinkled among these shorter hairs and also at the ends of the other toes are a few much longer bristles. Calcar about as long as tibia, its point ill-defined; no indication of keel or of terminal lobe. Tail about half as long as head and body, robust and muscular, the terminal third or half projecting beyond membrane.

Fur and colour.—The fur is everywhere dense and velvety in texture, the hairs at middle of back about 7 mm. in length, those on throat longer and looser. Colour a uniform light drab, with faint darker shading in certain lights, the hairs pale ecru-drab at extreme base. Ears and membranes in dry specimens blackish. Fringes on feet and hairy lines on ears, drab like body.

Skull.—The skull is large, but rather slender, about equal to that of *Myotis myotis* in length. In general form it is distinguishable among those of the bats of Europe by the depressed brain-case, the high, somewhat tubular rostro-interorbital portion, and the conspicuously emarginate inner side of auditory bullæ. Dorsal profile essentially straight from nares to lambda, though with a

slight convexity over anterior two-thirds of brain-case, and a more abrupt though not very conspicuous swelling posteriorly, the two convexities separated by a narrow concavity; general direction of dorsal profile more nearly horizontal than in any other European bat, since the depth of occiput through condyles is scarcely greater than that of rostrum through anterior portion of first molar. Brain-case low and wide, its depth at middle about half mastoid breadth, its surface smooth and evenly rounded, with faintly indicated sagittal crest posteriorly and median groove between lateral swellings anteriorly; lambdal crest evident though not high; outline of brain-case when viewed from above a somewhat triangular ovate owing to the rather squarely truncate posterior border and the strong contrast between the wide mastoid region and narrow interorbital constriction; floor of brain-case with median ridge and lateral depressions posteriorly, the basisphenoid with two shallow but rather well-defined pits about as large as glenoid surface; auditory bullæ rather large, deeply emarginate on inner side so that cochlea is conspicuously exposed, the region in front of middle of meatus reduced to a narrow ring barely more than one-third as wide as meatus, the extreme anterior border with a flange-like inward-curved projection. Interorbital region long, subcylindrical, a little wider at lachrymal level than posteriorly, but scarcely enough so to impart a distinctly hour-glass general form; least interorbital breadth slightly greater than breadth of tubular narial region and slightly less than that across roots of canines. Zygoma simple, not bent upward, its margin with a barely indicated expansion behind middle. Rostrum proper short and deep, not well differentiated from interorbital region, the distance from orbit to front of premaxillary about equal to depth at front of m^1; lachrymal ridge short but well defined, the small, inconspicuous anteorbital foramen and minute lachrymal foramen opening forward under its anterior edge, at level of middle of large premolar; nares with distinctly tubular lateral margins separated from roots of canines by evident grooves, the dorsal emargination extending about half way to lachrymal level. Palate moderately wide, noticeably concave laterally, the anterior emargination small, about as deep as wide, its posterior border scarcely extending behind level of front of canine; posterior border of palate double emarginate with well developed median projection, the emarginations extending forward to level of posterior margin of m^3; mesopterygoid space large, its width anteriorly equal to that of

FIG. 48.

Nyctinomus teniotis.
Nat. size.

temporal fossa at same level, its length about twice width; hamulars small and inconspicuous. Mandible long and straight, its axis scarcely bent upward posteriorly; symphysis deep, scarcely or not subtended by a concavity in lower border of ramus; posterior portion of mandible low, the depth through coronoid process barely equal to distance from front of coronoid to back of condyle; angular process large, straight, directed backward, outward and downward.

Teeth.—Relatively to size of skull the teeth are rather large, the lower molars in particular. The most obvious peculiarities of the dentition as compared with that of other European bats are the single, well developed incisor in each side of upper jaw, and the presence of a large hypocone, quite distinct from commissure of protocone, in m^1 and m^2. Upper incisor simple, a little more than half as high as canine, the shaft set at an angle so that the points of the two teeth are much nearer together than their bases; cingulum faintly indicated in front, better developed and forming an incipient cusp postero-externally; posterior surface of shaft somewhat flattened; space between incisor and canine about equal to greatest diameter of smaller tooth. Lower incisors three on each side, much imbricated and closely crowded in narrow space at front of canines, their cutting edge barely rising to level of canine cingulum. The inner and middle tooth sub-equal, rather deeply bifid, the outer barely equal to outer lobe of the others, its apex faintly notched. Upper canine moderately large, its crown area somewhat more than double that of upper incisor, the general outline of its base an irregular triangle with its longest side directed inward, and with the postero-external side slightly concave; cingulum narrow but well developed throughout, not tending to develop small cusps; lower canine with no special peculiarities, its cingulum tending to form a slight anterior cusp. Small upper premolar in the tooth-row, usually in contact with canine and separated from large premolar by a narrow space, its crown area somewhat less than that of upper incisor, its cingulum and cusp well developed, the cusp about one-fourth as high as shaft of canine, triangular in outline when viewed from the outside, with well developed posterior cutting ridge; lower premolars similar in form but larger, their crown areas sub-equal, the shaft of the second higher than that of first and about equal to larger cusps

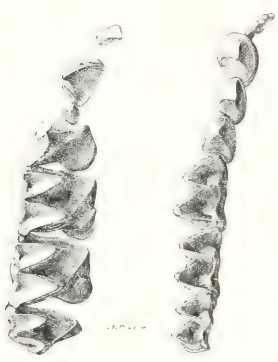

FIG. 49.

Nyctinomus leachii. Teeth × 5.

CRANIAL MEASUREMENTS OF *NYCTINOMUS TENIOTIS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Lachrymal breadth.	Breadth of brain-case.	Depth of brain-case at middle.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
Greece	46. 6. 15. 121	♀	23·8	14·0	4·8	8·0	11·4	6·4	17·0	9·2	10·0	Teeth not worn.
Italy	10. 5. 24. 1	♂	23·4	14·0	5·0	7·8	11·6	6·2	17·2	9·0	9·6	,, ,,
Portugal: Cintra . .	98. 2. 2. 6	♀	23·0	14·0	4·8	7·6	11·2	6·0	16·8	9·0	9·6	,, moderately worn.
,, . .	98. 2. 2. 7	♀	23·4	14·2	4·8	7·8	11·6	6·2	17·2	9·2	9·6	,, slightly worn.

of lower molars; large upper premolar with crown area about two-thirds that of m^1, its antero-internal cusp high and distinct. First and second upper molars alike in structure, the first slightly larger than second, the cusps all well developed and distinct, showing no special peculiarities aside from the presence of a conspicuous terete hypocone nearly as large and distinct as antero-internal cusp of large premolar, and separated from commissure of protocone by a deep notch; third upper molar with crown area not much less than that of second, except for the absence of postero-internal heel and hypocone; third commissure as long as in the other teeth, but metacone smaller than paracone. Lower molars with no special peculiarities, the cusps all well developed and distinct.

Measurements.—Young adult male from Italy: head and body, 87; tail, 56; free portion of tail, 20; tibia, 19; foot, 10·4; **forearm**, 60·4; third finger, 115; fifth finger, 65; ear from meatus, 30·4; width of ear, 32. Young adult female from Greece: head and body, 84; tail, 57; free portion of tail, 27; tibia, 20; foot, 11·4; **forearm**, 61; third finger, 117; fifth finger, 61; ear from meatus, 31·4; width of ear, 31. Two adult females from Cintra, Portugal: **forearm**, 60 and 61; third finger, 110 and 115; fifth finger, 59 and 63. For cranial measurements see Table, p. 281.

Specimens examined.—Six, from the following localities:—

Portugal: Cintra, 2.

Italy: No exact locality (probably from Pisa), 2. (B.M. and U.S.N.M.); Sicily, 1 (U.S.N.M.).

Greece: No exact locality, 1.

2 ♀.	Cintra, Portugal.	O. Thomas (c & p).	98. 2. 2. 6–7.
♂.	Italy (probably Pisa). (*Savi.*)	Zoological Society (p).	10. 5. 24. 1.
♀.	Greece.	Parreys.	46. 6. 15. 121.

Order CARNIVORA.

1827. *Carnivora* Gray, Griffith's Cuvier. Anim. Kingd., v, p. 111.

Geographical distribution.—Continents and larger islands of the entire world, Australia,* New Zealand, and the Antarctic region excepted.

Characters.—Terrestrial (rarely aquatic or semi-aquatic), non-volant, placental mammals with rather high development of brain, the cerebral hemispheres with distinct convolutions; feet unguiculate, never modified as fins or flippers; dentition of a modified tuberculo-sectorial type, the posterior upper premolar and anterior lower molar usually developed as special carnassial or flesh-cutting teeth.

Remarks.—The mammals of this order present much diversity of form and structure, though less than in the case of the *Insectivora*. Most of the living members of the group are carnivorous in habits, and immediately recognizable among placental mammals by the presence of a specially modified flesh-tooth in each jaw. In certain groups, however, as in the *Ursidæ* among the European representatives of the order, both habits and dentition are of a more generalized type. The order contains seven recent families, five of which occur in Europe.

KEY TO THE EUROPEAN FAMILIES AND SUB-FAMILIES OF *CARNIVORA*.

Larger cheek-teeth with crowns of a crushing type, the cusps sub-equal, low, subterete, without noticeable cutting edges; upper carnassial 2-rooted, in front of anteorbital foramen, its inner lobe posterior; size very large; form heavy; feet plantigrade (Bears) ... *Ursidæ*, p. 284.

Larger cheek-teeth with crown at least partly trenchant, the outer cusps of one or more in each jaw narrow and with well developed cutting edge, the inner cusps reduced or absent; upper carnassial 3-rooted, behind anteorbital foramen, its inner lobe median or anterior.

Cheek-teeth without crushing surfaces; upper molar scarcely larger than outer incisor; claws completely retractile (Cats) ..... *Felidæ*, p. 455.

Cheek-teeth, at least the hindermost, with evident crushing surface; upper molar (or first when more than one are present) much larger than outer incisor; claws partly or not retractile.

Tooth-row relatively long (more than half condylo-basal length of skull); number of teeth in European members of family 42 (Dogs)..... *Canidæ*, p. 303.

* Represented in Australia by a species of *Canis*, probably introduced.

Tooth-row relatively short (less than half condylo-basal length of skull); number of teeth in European members of family not more than 40.
Auditory bulla divided into two chambers, the boundary between which is marked externally by an oblique constriction; upper molars usually (always in European genera) 2–2, the crown of the first wider externally than internally (Genets and Mongoose)..... *Viverridæ*, p. 440.
Auditory bulla simple; upper molars 1–1, the crown wider internally than externally ..... *Mustelidæ*, p. 340.
Upper carnassial with evident crushing surface on inner side, the crown triangular or rhombic in outline; upper molar large, the length of its outer portion usually equal to or greater than that of carnassial.
Skull normal, the rostrum longer than broad; external form not modified for aquatic life, the toes long-clawed, not webbed, the tail not conspicuously muscular; fur loose and coarse (Badgers)..... *Melinæ*, p. 341.
Skull much flattened; rostrum broader than long; external form modified for aquatic life, the toes short-clawed, webbed, the tail conspicuously muscular; fur dense and fine (Otters)..... *Lutrinæ*, p. 354.
Upper carnassial without crushing surface on inner side other than a small concave area between small inner lobe and main cusp, the crown not triangular or rhombic in outline; upper molar much reduced, the length of its outer portion one-third to one-half that of carnassial.
Dentition highly trenchant; small premolars not opposite, at least one pair capable of shearing action; upper carnassial with posterior cusp narrow and trenchant; auditory bulla longer than broad; form slender; feet digitigrade (Martens and Weasels)..... *Mustelinæ*, p. 364.
Dentition not highly trenchant; small premolars opposite, not capable of shearing action, the points of all but pm^3 and pm_4 widely separated when jaws are closed; upper carnassial with posterior cusp broad, almost flat-topped; auditory bulla broader than long; external form heavy; feet sub-plantigrade (Glutton)..... *Guloninæ*, p. 432.

Family URSIDÆ.

1825. *Ursidæ* Gray, Thomson's Annals of Philosophy, xxvi, p. 339, November, 1825.

Geographical distribution.—Northern hemisphere, south in the Old World to the Atlas Mountains and the Malay Archipelago, and in America to the Andes.

Characters.—Larger cheek-teeth of a strictly crushing type, the crowns wide and flattened, with large terete cusps, the last

upper premolar and first lower molar scarcely differentiated as carnassials, the former 2-rooted, its inner lobe at posterior border of crown, its position so far anterior to level of anteorbital foramen as not to be at point of greatest mechanical efficiency; auditory bulla flattened, without septum; form heavy; size large; feet strictly plantigrade; digits, 5-5.

Remarks.—The family *Ursidæ*, containing the bears, is at present represented by five or six genera, though the fossil remains of others are known. The members of the group are so easily recognizable by the peculiarities of the cheek-teeth that they require no special comparisons with other carnivora. Two genera occur in Europe.

KEY TO THE EUROPEAN GENERA OF *URSIDÆ*.

Cheek-teeth relatively large; incisors and canines not specially enlarged and prehensive (Ordinary Bears) ..... *Ursus*, p. 285.
Cheek-teeth relatively small; incisors and canines enlarged and unusually prehensive in character (Polar Bears) ..... *Thalarctos*, p. 297.

Genus **URSUS** Linnæus.

1758. *Ursus* Linnæus, Syst. Nat., I, 10th ed., p. 47 (*arctos*, by tautonymy).
1857. *Ursus* Blasius, Säugethiere Deutschlands, p. 196.
1864. *Euarctos* Gray, Proc. Zool. Soc. London, p. 692 (*americanus*).
1864. *Myrmarctos* Gray, Proc. Zool. Soc. London, p. 694 (*eversmanni* = *arctos*).
1898. *Ursarctos* Heude, Mém. Hist. Nat. Emp. Chinois, IV, pt. I, p. 18 (*yesoensis*).

Type species.—*Ursus arctos* Linnæus.

Geographical distribution.—Northern hemisphere from northern limits of the great continental areas south to the Atlas Mountains, the Himalayas and Mexico.

Characters.—Dental formula: $i\ \frac{3-3}{3-3}$, $c\ \frac{1-1}{1-1}$, $pm\ \frac{4-4}{4-4}$, $m\ \frac{2\ 2}{3\ 3} = 42$; inner upper incisor well developed, permanent; first, second and third premolars in both jaws small, single-rooted, readily deciduous, especially pm^2, pm_2 and pm_3; molars large and robust, the length of the two upper teeth together equal to width of palate.

Remarks.—The genus *Ursus* as thus restricted is a very homogeneous group practically confined to the north temperate region. The species are at present so imperfectly known that no fair estimate can be made of their number. Recently about thirty forms have been recognized, only one of which is definitely known to occur in Europe.

URSUS ARCTOS Linnæus.

1758. [*Ursus*] *arctos* Linnæus, Syst. Nat., I, 10th ed., p. 47 (Sweden).
1772. [*Ursus*] *ursus* Boddaert, Kortbegrip van het zamenstel der Natuur, I, p. 46 (Renaming of *arctos*).
1788. [*Ursus arctos*] α *niger* Gmelin, Syst. Nat., I, 13th ed., p. 100 (Northern Europe).

1788. [*Ursus arctos*] β *fuscus* Gmelin, Syst. Nat., I, 13th ed., p. 100 (Alps).

1778. [*Ursus arctos*] γ *albus* Gmelin, Syst. Nat., I, 13th ed., p. 100 (Unknown; based on the "ours blanc terrestre" of Buffon).

1792. *U*[*rsus*] *arctos griseus* Kerr, Anim. Kingd., p. 184 (Germany; also in northern North America).

1797. *Ursus arctos rufus* Borkhausen, Deutsche Fauna, I, p. 46 (Swiss and Tirolean Alps).

1798. *Ursus badius* Schrank, Fauna Boica, I, p. 55 (Forests on the Bohemian boundary).

1808. *Ursus fuscus* Tiedemann, Zoologie, I, p. 374 (Substitute for *arctos*).

1814. *Ursus alpinus* Fischer, Zoognosia, III, p. 161 (Alps? Based on an individual seen alive in Paris).

1820. *Ursus arctos major* Nilsson, Skand. Fauna, I, p. 112 (Wooded portions of southern Scandinavia).

1820. *Ursus arctos minor* Nilsson, Skand. Fauna, I, p. 123 (Northernmost Scandinavia).

1827. [*Ursus arctos*] β *brunneus* Billberg, Synopsis Faunæ Scandinaviæ, p. 15 (Northern Scandinavia).

1827. [*Ursus arctos*] γ *annulatus* Billberg, Synopsis Faunæ Scandinaviæ, p. 15 (Northern Scandinavia).

1827. [*Ursus arctos*] δ *argenteus* Billberg, Synopsis Faunæ Scandinaviæ, p. 15 (Northern Scandinavia).

1827. [*Ursus*] *myrmephagus* Billberg, Synopsis Faunæ Scandinaviæ, p. 16 (Northern Scandinavia).

1828. [*Ursus*] *formicarius* Billberg, Synopsis Faunæ Scandinaviæ, 2nd ed., p. 16 (Renaming of *myrmephagus*).

1829. *U*[*rsus*] *pyrenaicus* Fischer, Synopsis Mamm., p. 142. Latinization of "Ours des Pyrenees" F. Cuvier, Hist. Nat. des Mammif., V, fasc. 44, 1824 (Asturias, Spain).

1829. *U*[*rsus*] *norvegicus* Fischer, Synopsis Mamm., p. 142. Latinization of "Ours de Norwège" F. Cuvier, Hist. Nat. des Mammif., II, fasc. 7, 1819 (Norway).

1836. ? *Ursus falciger* Reichenbach, Regn. Anim. Icon., I, p. 32 ("Pyrenees"; afterwards supposed to be an individual of "*U. ferox*." See Naturgesch. des In- und Auslands, Raubsäugeth., p. 299, 1852).

1842. *Ursus pyrenæus* F. Cuvier, Hist. Nat. des Mamm., Tabl. gen., p. 3 (Described in fasc. 44, 1824) (Asturias, Spain).

1847. ? *Ursus curyrhinus* Nilsson, Skand. Fauna, I, 2nd ed., p. 212 (Sweden? Type an individual raised in captivity).

1857. *Ursus arctos* Blasius, Säugethiere Deutschlands, p. 196.

1861. *Ursus arctos aureus* Fitzinger, Wissensch.-pop. Naturgesch. der Säugeth., I, p. 372 (Norway).

1864. [*Ursus arctos*] var. 1. *normalis* Gray, Proc. Zool. Soc., London, p. 682 (Renaming of *arctos*).

1864. [*Ursus arctos*] sub-var. a. *scandinavicus* Gray, Proc. Zool. Soc., London, p. 682 (Based on Nilsson, Illum. Fig. Skand. Fauna, pl. 23).

1864. ? [*Ursus arctos*] sub-var. c. *rossicus* Gray, Proc. Zool. Soc., London, p. 682 (*nomen nudum*).

1864. [*Ursus arctos*] sub-var. f. *polonicus* Gray, Proc. Zool. Soc., London, p. 682 (Poland; based on Cuvier, Oss. Fossiles, IV, p. 332, pl. XXII, fig. 3).

1864. [*Ursus arctos*] var. 2. *grandis* Gray, Proc. Zool. Soc., London, p. 684 ("North of Europe"; based on "a male purchased at Hull, living in the Zoological Gardens from 1852 to 1863").

1864. [*Ursus arctos*] var. 4. *stenorostris* Gray, Proc. Zool. Soc., London, p. 685 (Poland; based on Cuvier, Oss. Fossiles, IV, p. 332, 2nd var., pl. XXII, fig. 4).

1864. *Myrmarctos eversmanni* Gray, Proc. Zool. Soc., London, p. 695 (Norway).

1910. *Ursus arctos, U. arctos formicarius, U. arctos alpinus*, and *U. arctos pyrenaicus* Trouessart, Faune Mamm. d'Europe, pp. 67–68.

Type locality.—Sweden.

Geographical distribution.—Entire continent of Europe wherever sufficiently extensive forests remain; east into Asia; west formerly to Great Britain, where it became extinct about the eleventh century; not certainly known to have occurred in Ireland.

Diagnosis.—Size moderate, condylobasal length of skull ranging from about 260 to 350 mm.; interorbital region noticeably elevated, the frontal profile strongly convex; mesopterygoid region not specially shortened and broadened, the width between pterygoids decidedly less than half distance from hamular to level of last molar; colour brown or buffy, varying much in exact shade, the legs usually darker than body, and feet darker than legs.

External characters.—General form short and heavy, this made more apparent by the long rather loose fur. Head moderately pointed, rather broad posteriorly; ear short, narrowly rounded off above, nearly concealed in the fur, its tip not extending to eye when laid forward; muzzle squarely truncate, its pad naked, the upper border somewhat projecting backward, its lower border separated from upper lip by a broad hairy area crossed at middle by a nearly bare perpendicular line. Fore foot with digits robust, inconspicuously graduated, the third and fourth sub-equal and longest, the fifth and second sub-equal and slightly shorter, the first with anterior edge of ball extending about to middle of that of second, this interval greater than in the case of the other digits; claws strongly curved, blunt, without evident cutting edges, their length at least twice that of those on hind foot; balls of digits large, pad-like, their surface, like that of pads, coarsely rugose; main pad wider than long, covering more than half surface of palm, its outer border about twice as long as inner, its porterior border slightly concave, its inner portion, at base of thumb, marked off from rest of pad by a slight furrow; region between main pad and balls of digits densely furred; wrist pad about as large as ball of digits, near outer margin of palm, its long diameter transverse; region between wrist-pad and main pad densely furred; hairs along edge of palm standing out stiffly, especially on outer side. Hind foot longer than fore foot, the second and third digits sub-equal and longest, the first and fourth slightly shorter, the fifth with anterior edge of ball at middle of that of fourth; pad like that of fore foot, but with a broad backward extension passing along inner side nearly or

quite to heel; region between pad and balls of toes, and at outer side of backward extension densely furred: fringe along edge of foot conspicuous. Tail very short, concealed in the fur.

Colour.—The colour of body is usually a light brown or dull buff, the head not essentially different, but feet and outer surface of legs darker. Many individual differences in colour have been described, some of which are probably characteristic of geographical races.

Skull.—General form of skull rather robust, the rostrum

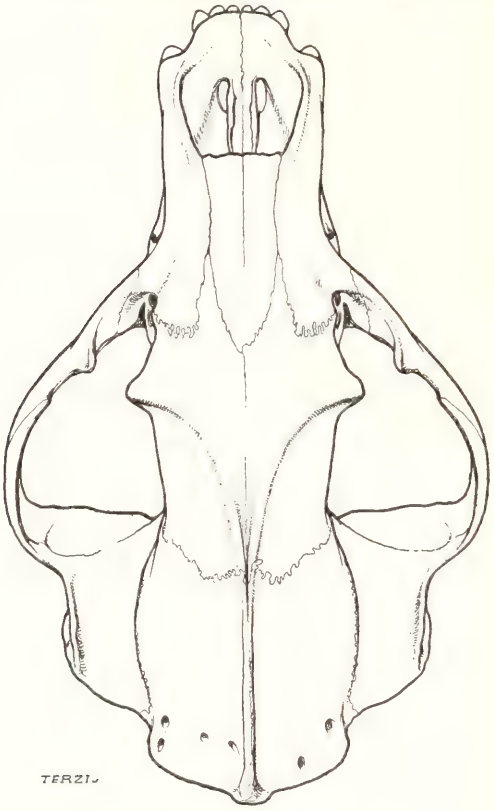

FIG. 50.
Ursus arctos. × ½.

moderately long (distance from orbit to front of premaxillary contained about 2½ times in condylobasal length), the brain-case

deep (depth to level of under side of postglenoid process considerably more than distance from tip of postorbital process to middle of interparietal) but not unusually wide (mastoid breadth slightly exceeding depth to under side of postglenoid process). Dorsal profile usually with an evident concavity in interorbital region, but this character showing much variation; highest point at bregma or slightly further forward, the profile nearly straight and sloping away at an angle of about 20° behind this point to slightly overhanging lambdal region; ventral profile faintly and

FIG. 51.
Ursus arctos. × ⅓.

evenly concave throughout. Brain-case broadly ovate in outline, its greatest breadth about equal to distance from bregma to lambda,* its depth at middle, exclusive of sagittal crest, slightly less than greatest breadth; lambdoid and sagittal crests well developed in adults, the lambda noticeably projecting so that occiptal condyles are scarcely visible when skull is viewed from above, and region between crest and foramen magnum is deeply concave; sagittal crest dividing in region of bregma into two ridges, one of which

* Except in very old individuals in which the lambda is greatly produced backward.

runs to extremity of each postorbital process, the hinder margin of which it forms ; occiput when viewed from behind moderately broad, the depth from lambda to lower lip of foramen magnum contained $1\frac{2}{3}$ to $1\frac{3}{4}$ times in mastoid breadth ; mastoid processes, paroccipital processes, and condyles extending to about the same

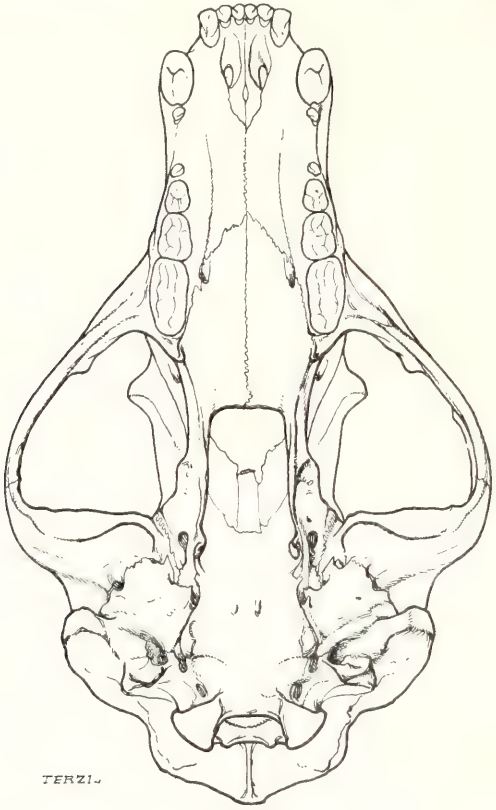

FIG. 52.
Ursus arctos. × ¼.

level. Floor of brain case nearly flat, the basioccipital with raised edges applied to inner surface of bullæ, and in some specimens marked by an evident concavity on each side of median line ; auditory bulla flat, not rising above edge of basioccipital, the greatest longitudinal diameter less than transverse diameter, the

meatus distinctly tubular, usually longer than wide; postglenoid process heavy, rising to level of hamulars. Interorbital region broad, the width across robust, triangular, postorbital processes about equal to that of brain-case, the region immediately between orbits always a little concave and sometimes conspicuously so, that at base of each postorbital process usually somewhat swollen. Zygomata moderately expanded, the greatest zygomatic breadth opposite anterior glenoid edge; orbital process well developed. Rostrum equal to less than half condylobasal length of skull, the width across alveoli of canines equal to or less than depth at front of orbit, the depth at front of nasal equal to about half distance from orbit to front of premaxillary; nares rather large, their lateral margins slightly everted; nasal bones elongate wedge-shaped, squarely truncate anteriorly, their posterior extremity on level with or extending slightly behind nasal branch of maxillary; anteorbital foramen over metacone of m^1 or paracone of m^2; palate narrow, its width between posterior molars contained about $3\frac{1}{2}$ times in median length; extension behind molars nearly parallel-sided, its length equal to about three-quarters breadth; mesopterygoid space $1\frac{1}{2}$ times to twice as long as wide, its anterior border squarish or rounded, its lateral borders nearly parallel; hamulars small but distinct, slightly hooked outward. Mandible robust, the depth of ramus behind large premolar contained about five times in length, the height of posterior portion (measured to level of lower border) a little less than half length; coronoid process broad, its width at level of alveolus slightly greater than height, the anterior border at first straight then evenly convex to overhanging tip, the posterior border concave; angular process short, extending slightly if at all behind level of articular process, its inner border nearly straight, its outer border convex.

Teeth.—The teeth are moderately large relatively to size of skull. Upper incisors forming a continuous row, separated at each side from canine by a diastema about as wide as inner incisor; i^1 and i^2 sub-equal, the former slightly the smaller, the anterior face smoothly rounded, a little more than half as wide as high, the posterior face abruptly concave, with shelf-like posterior extension, the cingulum slightly developed and forming a rudimentary nodule on inner and outer side of i^2 and on outer side of i^1 near level of middle of anterior surface; i^3 with crown area nearly double that of i^2, and height nearly half that of canine, its anterior surface smoothly rounded but with pronounced nodule on inner side, its posterior surface gradually concave and without shelf-like extension; a thickened ridge along its inner border and a low but somewhat trenchant ridge slightly outside of middle. Lower incisors forming continuous row between canines, their crown area increasing regularly from first to third, their height approximately equal; each has a high inner cusp and a low outer tubercle best developed in i_3; posterior border slightly

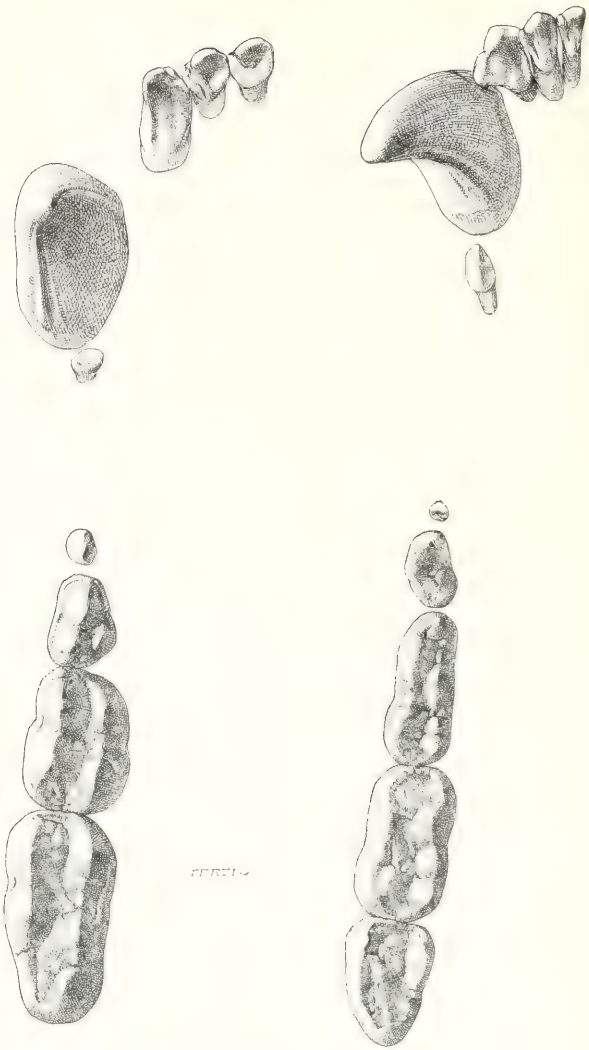

FIG. 53.

Ursus arctos. Teeth nat. size.

concave, with inner, middle and outer ridges, the inner and middle low and confluent in i_1. Canines large and strong, oval or slightly ovate in cross section, the longest diameter at level of alveolus equal to or slightly greater than distance from alveolus to median line of palate; lower canine shorter and a little more curved than upper; a slightly developed posterior and antero-internal longitudinal ridge, most evident in upper tooth; no cingulum. First and third upper premolars small, flat topped, with slightly indicated cusp and posterior and antero-internal ridge, the crown area slightly less than that of smallest incisor, the first close to canine, the third close to large premolar; third near middle of space between first and second, much smaller than the others and frequently deciduous, its crown indefinitely rounded; fourth upper premolar with crown area about half that of first molar, its general outline triangular with apex directed forward, the outer side longest, the posterior border shortest, the contrast between them sometimes noticeable, in other instances slight, the three cusps lying near respective angles, the anterior highest (reaching level of main cusps of molars) and most robust, the postero-internal and postero-external abruptly smaller, sub-equal, the inner usually lower than the outer; a small accessory tubercle usually present at posterior base of postero-outer cusp; cingulum obsolete but usually visible along inner base of anterior cusp and outer base of postero-external cusp; first and second lower premolars approximately like corresponding upper teeth in both size, form and position; third very early deciduous, usually if not always absent in adult individuals; fourth in contact with first molar and with from one-third to nearly one-half its crown area, the outline irregularly quadrilateral with well developed antero-external cusp nearly as high as main cusps of molars, a rudimentary antero-internal cingulum cusp, and a tuberculated ridge extending along outer side of crown from antero-external cusp to posterior border; occasionally a similar ridge is present on inner side of crown, its anterior tubercle forming an evident cusp at inner posterior base of main cusp. First upper molar with crown much less than twice as long as broad, its outer side bi-convex, its inner side evenly rounded, its two outer cusps sub-equal in both height and diameter, the two inner cusps decidedly lower than outer, and less well defined, owing to the presence of a low, ridge-like tubercle between them; both outer and inner cusps when unworn have distinct though low anterior and posterior trenchant ridge; space between outer and inner cusps occupied by a rather well defined longitudinal groove, the surface of which is marked by irregular low ridges and furrows; cingulum obsolete, but indicated in the regions between the cusps; second upper molar nearly twice as long as broad, the anterior two-thirds approximately like first molar, with the same four cusps and intermediate longitudinal groove, the main axis of which is, however, in axis of tooth-row instead of slightly

Locality	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Mastoid breadth.	Postorbital constriction.	Interorbital constriction.	Rostral breadth over canines.	Palatal depth behind last molar.	Rostral depth at front of *pm*4.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
U. arctos.														
Sweden . . .	62. 3. 29. 8	♂	292·0	170·0	128·0	67·0	68·0	63·0	81·0	62	214	112·0	129·0	Basal suture open.
,, . . .	22393	♂	298·0	173·0	130·0	69·0	73·6	70·0	82·0	58	215	110·0	129·0	,, ,,
,, . . .	62. 3. 29. 7	♂	325·0	215·0	161·0	71·0	78·0	74·0	94·0	62	245	122·0	144·0	,, closed.
,, Kvickjock .	90. 8. 1. 3	♀	258·0	157·0	106·0	68·0	64·0	65·0	76·0	48	189	106·0	120·0	,, open.
Switzerland: Engadine	86. 1. 23. 1	♀?	255·0	155·0	114·0	65·0	61·0	58·0	70·0	53	185	102·0	115·0	,, ,,
Austria-Hungary: near Hatszeg, Hunyad .	78. 1. 16. 1	♀	295·0	197·0	135·0	71±	79·0	70·0	80·0	59	208	111·0	127·0	,, closed.
,, ,, ,,	78. 1. 16. 3	♂	288·0	165·0	127·0	61·0	59·0	64·4	79·0	50	210	105·0	124·0	,, open.
Russia. . . .	4441 (U.S.N.M.)		337·0	191·0	156·0	74·0	71·0	73·6	91·0	61	240	123·0	141·0	,, ,,
U. "formicarius."														
Switzerland: Grisons .	Lausanne		240·0	135·0	99·0	—	51·0	55·4	63·0	41	173	93·0	110·0	,, ,,
T. maritimus.														
Griffin Bay: Wellington Channel . . .	90. 8. 4. 1	♂	391·0	249·0	183·5	75·0	110·4	165·0	160·0	88	258	135·4	151·0	All sutures closed.
No history . . .	88. 3. 20. 2	♀	331·4	187·4	139·0	68·6	79·0	78·0	85·5	76	233	117·0	132·4	Basal suture closed.

DENTAL MEASUREMENTS OF *URSUS ARCTOS*, *U. "FORMICARIUS"* AND *THALARCTOS MARITIMUS*.

Locality.	Number.	Sex.	Last upper premolar.	First upper molar.	Second upper molar.	First lower molar.	Second lower molar.	Third lower molar.
U. arctos.								
Sweden	62. 3. 29. 8	♂	16·2 × 13·0	21·4 × 16·0	35·0 × 17·0	22·6 × 11·0	24·0 × 15·4	20·0 × 15·0
,, ...	22393	♂	15·0 × 10·0	20·0 × 15·0	30·0 × 16·6	22·0 × 10·2	22·2 × 13·2	17·4 × 14·0
,, ...	62. 3. 29. 7	♂	14·0 × 11·0	21·0 × 15·4	31·4 × 16·6	23·0 × 11·0	24·0 × 14·0	17·2 × 14·0
,, Kvickjock . .	90. 8. 1. 3	♀	15·0 × —	20·0 × 15·4	30·0 × 17·4	22·6 × 11·0	21·0 × 13·0	15·4 × 14·0
Switzerland: Engadine .	86. 1. 23. 1	♀?	14·2 × 10·4	19·4 × 14·8	29·6 × 17·0	20·2 × 10·0	21·4 × 13·2	16·6 × 13·8
Austria-Hungary: Hatszeg, Hunyad . .	78. 1. 16. 1	♀	15·4 × 12·8	20·0 × 16·4	31·0 × 18·4	21·6 × 10·4	23·0 × 15·0	19·0 × 13·6
,, ,, ,,	78. 1. 16. 3	♂	15·4 × 11·4	21·4 × 16·0	33·4 × 16·4	22·4 × 11·2	23·4 × 14·0	18·0 × 12·4
Russia	4441		17·0 × 14·8	24·0 × 18·0	37·6 × 20·0	25·6 × 12·2	25·4 × 15·8	21·2 × 15·6
U. "formicarius."								
Switzerland: Grisons .	Lausanne		—	22·0 × 15·0	30·0 × 16·0	22·0 × 11·0	22·8 × 13·8	17·0 × 14·6
T. maritimus.								
Griffin Bay: Wellington Channel . . .	90. 8. 4. 1	♂	16·4 × 8·8	20·6 × 15·0	27·8 × 15·0	21·0 × —	21·4 × 11·8	—
No history . . .	88. 3. 20. 2	♀	—	—	23·2 × 13·4	21·0 × 8·8	19·2 × 10·8	—

oblique to it; postero-external cusp slightly smaller than antero-external, and contrast between outer and inner cusps less marked than in m^1; posterior third of crown occupied by a flattened heel, variable in form and size, but usually narrowing off, chiefly by slanting inward of outer border, to about half anterior width of tooth, and in some specimens bearing a low but evident third inner tubercle; surface of heel sculptured by irregular small tubercles and furrows; cingulum obsolete but usually evident along anterior half of inner border. First lower molar about as long as second but noticeably narrower, its crown showing more traces of the primitive trituberculate form than any of the other teeth; protoconid and hypoconid wide apart, separated by a deep groove, the protoconid the highest cusp in the tooth, and with evident antero-external commissure; paraconid forming narrow anterior extremity of crown and provided with a distinct commissure, similar to and joining that of protoconid; metaconid subterete, without commissure, near to and slightly behind inner base of protoconid, a minute though evident accessory tubercle just in front of it; entoconid like hypoconid, at extreme posterior edge of crown, the deep wide groove between it and metaconid with small accessory tubercle at its lowest point. Second lower molar about $1\frac{1}{2}$ times as long as wide, its outline an irregular parallelogram with rounded-off corners, the surface of the crown occupied principally by a flattened, irregularly sculptured crushing surface, the cusps near border; five cusps are usually well developed: a rather large antero-internal and antero-external opposite each other, and joined by a low transverse ridge; a small postero-external and two smaller postero-internal cusps; a small but evident accessory tubercle at anterior base of large antero-internal cusp, this tubercle not infrequently dividing into two. Third lower molar varying from rounded-triangular to ovate in outline, its area about two-thirds that of m_2, its surface entirely flat except for a slightly raised rim which forms a small antero-internal cusp.

Measurements.—Adult male from Sweden (mounted): head and body, 1900; tail, 80; hind foot, 195; ear, 90. For cranial measurements see Table, p. 294.

Specimens examined.—Eight, from the following localities:—

Sweden: Kvickjock, Norbotten, 1; no exact locality, 3 (B.M. and U.S.N.M.).

Switzerland: Engadine, 1.

Austria-Hungary: Near Hatszeg, Hunyad, 3.

Remarks.—As regards the existence of geographical races of the large European bear it is impossible to form any opinion on the basis of the few specimens seen. *Ursus arctos* is related to the grizzly bear of North America, *U. horribilis* and its local forms, but is readily distinguishable by the relatively greater height of the frontal region and the consequently more abrupt slope of posterior half of dorsal profile, a character suggesting

Ursus richardsoni; forehead in most specimens rising abruptly above level of rostrum so as to produce a noticeable concavity in dorsal profile, but this character subject to marked variations, the exact nature of which is not fully understood. The skulls of the two species are of approximately the same size, those of *U. horribilis* perhaps averaging somewhat the larger. The teeth of the two animals are also much alike.

♀.	Kvickjock, Norbotten, Sweden.	Stockholm Museum (E).	90. 8. 1. 3.
2 ♂.	Sweden. (*Lloyd.*)	Purchased (Stevens).	62. 3. 29. 7-8.
♀ st.	Engadine, Switzerland.	H. Justen (F).	86. 1. 23. 1.
3 skeletons.	Hatszeg, Transylvania, Hungary.	C. G. Danford (C).	78. 1. 16. 1 3.

Note on the *Ursus formicarius* of Bieler.

A peculiar small bear supposed to have been taken in the Canton of Grisons, Switzerland, has been described by Professor Bieler of the Lausanne Agricultural College as *Ursus formicarius* Eversmann.* Through the author's kindness I have had the opportunity to examine this skull. It is that of a rather young individual, apparently a female, with basal suture open, but with teeth showing slight indications of wear. In size it is smaller than in a female of the same age or slightly younger from Sweden (see Table of cranial measurements, p. 294), the interorbital region is much depressed, so that the frontal profile is nearly flat, and the mesopterygoid fossa is unusually broad and short, the width between pterygoids equal to a little more than half distance from hamular to level of last molar. The teeth on the other hand are slightly larger than usual in females (see Table, p. 295); in form they show no special peculiarities. Small bears, presumably of this type, have been reported from Spain, northern Italy, Russia and Scandinavia, and have formed the basis of such names as *Ursus formicarius, U. arctos minor* and *Myrmarctos eversmanni.* Until more is known of them, as well as of the normal variation in ordinacy *Ursus arctos*, their status must remain in doubt.

Genus **THALARCTOS** Gray.

1825. *Thalarctos* Gray, Ann. of Philosophy, N.S., x, p. 62, July, 1825.

1825. *Thalassarctos* Gray, Ann. of Philosophy, N.S., x, p. 339, November, 1825.

1896. *Thalassiarchus* Kobelt, Bericht Senckenberg. naturforsch. Gesellsch. Frankfurt am Main, p. 93 (Substitute for *Thalarctos*).

Type species.—*Thalarctos polaris* Gray = *Ursus maritimus* Phipps.

* Compte-Rendu des Séances du Sixième Congrès Internationale de Zoologie, Berne, 1904, p. 248. 1905.

Geographical distribution.—North Polar region, south to northernmost continental coasts.

Characters.—Similar to *Ursus*, but cheek-teeth much less robust, the combined length of the two upper molars not equal to width of palate, and canines and incisors enlarged and more prehensive in general form.

Remarks.—The genus *Thalarctos*, though not very strongly differentiated from *Ursus*, is a well defined and perfectly natural group.

THALARCTOS MARITIMUS Phipps.

1774. *Ursus maritimus* Phipps, Voyage toward North Pole, p. 185 (Spitzbergen).

1776. *Ursus marinus* Pallas, Reise durch verschiedene Provinzen des russischen Reichs, III, p. 691 (Arctic Ocean).

1792. *Ursus polaris* Shaw, Museum Leverianum, I, p. 7 (Renaming of *marinus*).

1862. *Thalarctos maritimus* Gray, Catal. Bones Mamm. Brit. Mus., p. 105.

1908. ? *Thalassarctos jenaensis* Knottnerus-Meyer, Sitz.-Ber. Gesellsch. Naturforsch. Freunde, Berlin, p. 184, July, 1908 (Jena Island, Spitzbergen).

1908. ? *Thalassarctos spitzbergensis* Knottnerus-Meyer, Sitz.-Ber. Gesellsch. Naturforsch. Freunde, Berlin, p. 184, July, 1908 (Seven Island, Spitzbergen).

1910. *Ursus* (*Thalassarctos*) *maritimus* Trouessart, Faune Mamm. d'Europe, p. 66.

Type locality.—Spitzbergen.

Geographical distribution.—Arctic Ocean, south on floating ice occasionally to the northern coast of Norway. Details of distribution unknown.

Diagnosis.—General characters as in the genus; size very large; colour uniform whitish or buffy.

External characters.—Form longer and less heavy than in *Ursus arctos*, the neck noticeably longer and head longer and more pointed; ear actually as well as relatively shorter; fore foot with palmar tubercles and balls of toes essentially as in *U. arctos* but smaller; pad on hind foot without backward continuation along inner portion of sole; claws much less elongated than in *U. arctos*, not strongly curved, but with acute points and well developed cutting edges. Fur very dense, its texture almost seal-like in the short summer coat.

Colour.—Entire animal a uniform whitish or buffy, the winter pelage tending to be a creamy-white, the summer coat yellowish buff.

Skull.—The skull is considerably larger than that of *Ursus arctos*, with relatively longer brain-case, deeper, wider rostrum, and less elevated frontal region; lambdal region less produced backward than in *Ursus arctos*, the condyles usually visible when skull is viewed from above. Base of brain-case essentially as in *U. arctos*, but portion at base of condyles more narrowed and

elongate. Palate noticeably broader than in *Ursus arctos*, a character made more conspicuous by the relative weakness of the teeth. Mandible with no special peculiarities except that the

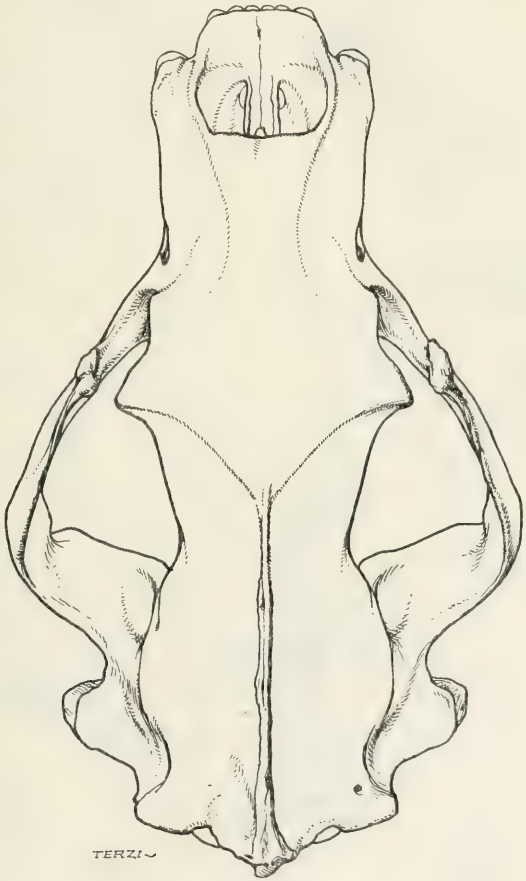

FIG. 54.
Thalarctos maritimus. × ⅛.

lower margin is nearly straight throughout, the posterior concavity being very slightly indicated, and lower border of angular process only a little elevated above general outline.

Teeth.—While the general character of the dentition differs

notably from that of *Ursus arctos* in the reduction of the molars and increased size and prehensiveness of the canines and incisors, the details of the individual teeth present little that is specially

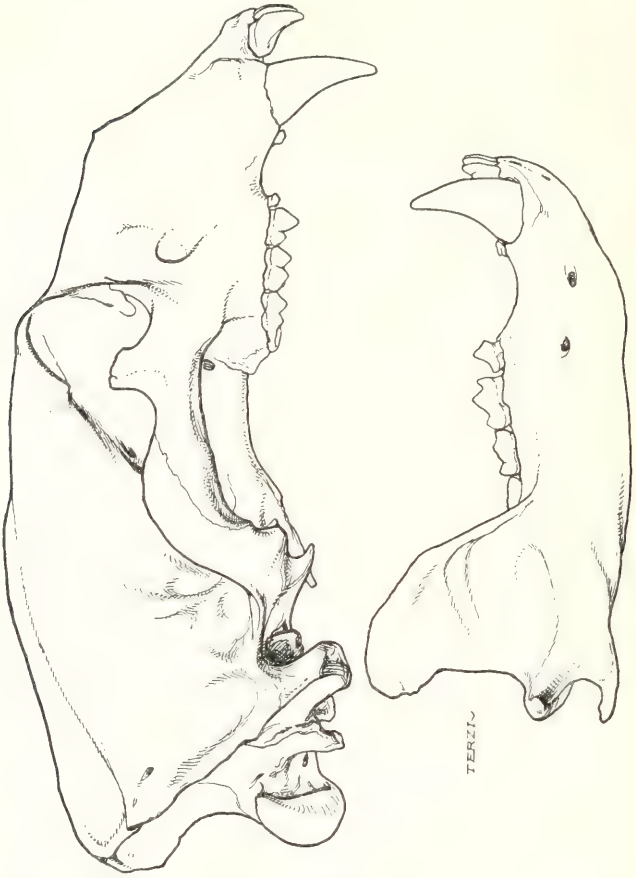

FIG. 55.

Thalarctos maritimus. × ¹.

noteworthy. General form of upper incisors as in *Ursus arctos*, but points of i^1 and i^2 narrower and more hooked backward ; i^3 with cusp more slender and ridges nearly obsolete ; lower incisors

with lobes more sharply defined. Canines both above and below essentially similar to those of *Ursus arctos*, except for their greater size. Owing to the greater width of palate the proportion of

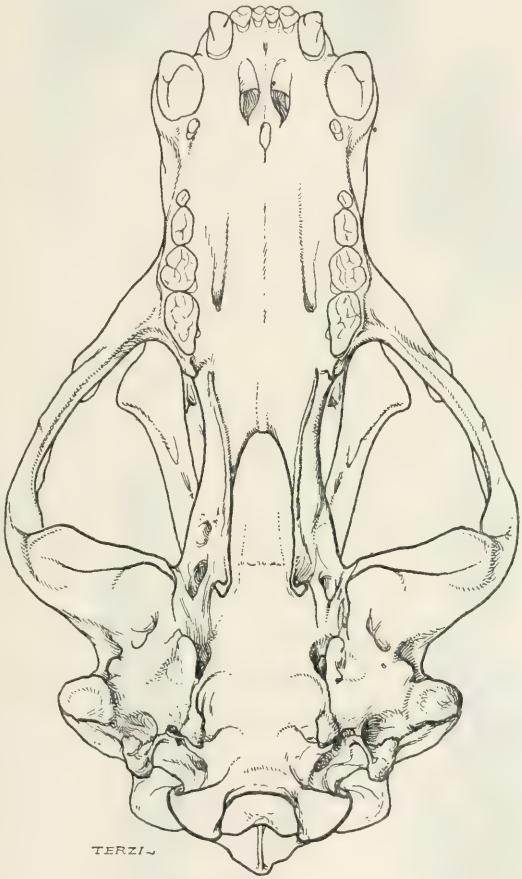

FIG. 56.

Thalarctos maritimus. × ⅓.

diameter of upper canine to palatal width is about as in the smaller-toothed animal. Small premolars showing no special peculiarities. Large upper premolar with relatively higher

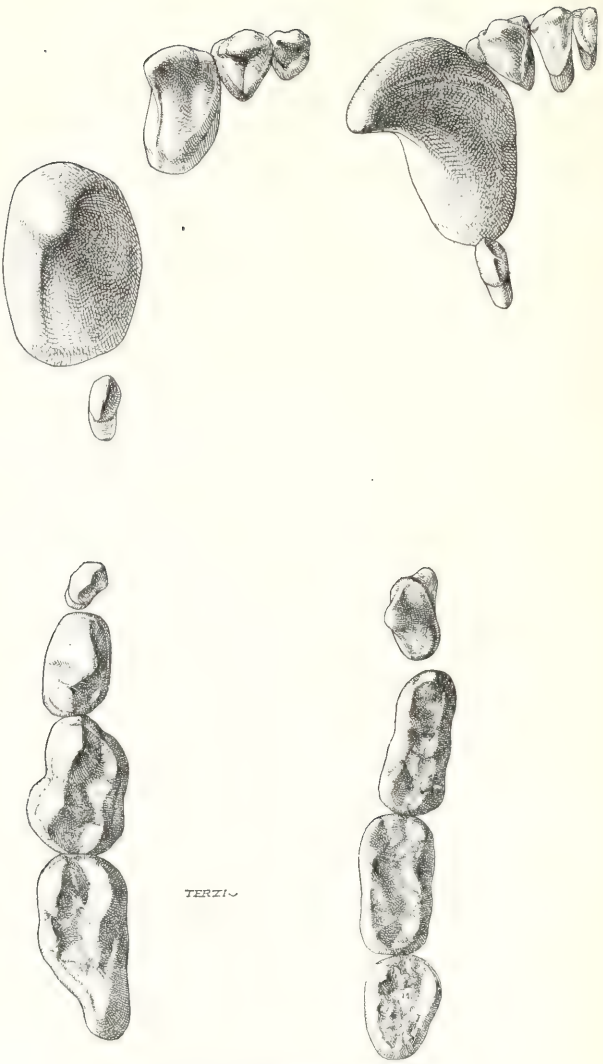

FIG. 57.
Thalarctos maritimus. Teeth nat. size.

anterior cusp than in *U. arctos*, its inner side more flattened, giving the tooth a more carnassial appearance; postero-internal cusp relatively less developed. Large lower premolar essentially as in *U. arctos* but with somewhat more slender cusp. Molars differing from those of *Ursus arctos* in their smoother, less sculptured crushing surface, and slightly more trenchant cusps. Form of m^1 not peculiar, though outer cusps are higher and narrower and inner cusps relatively lower; m^2 with inner cusps obsolete and heel relatively narrower and less developed. Anterior lower molar with metaconid and its accessory tubercle reduced to a low irregularly tuberculate ridge; commissure of protoconid and paraconid obsolete; hypoconid and entoconid smaller and much nearer together than in *Ursus arctos*, though separated from anterior cusps by a normally wide interval, in which, however, there are no definitely formed accessory tubercles. Second lower molar with the same elements as in *U. arctos* except for the absence of all trace of an intermediary tubercle on inner side of crown. Third lower molar with crown nearly flat, its margin showing only the faintest trace of antero-internal and antero-external elevations.

Measurements.—Adult male from Behring Strait (mounted): head and body, 2670; tail, 90; hind foot, 370; ear, 80. For cranial measurements see Table, p. 294.

Specimens examined.—Nine, from the following localities:—Spitzbergen, 1 (U.S.N.M.); Griffin Bay, Wellington Channel, 1; Melville Island, 1; Arctic Ocean, 1; no history, 5.

[The Museum specimens appear all to have come from the American side of the Atlantic.]

Family CANIDÆ.

1821. *Canida* Gray, London Medical Repository, xv, p. 301, April 1, 1821.

Geographical distribution.—Essentially cosmopolitan; in Europe west to Ireland.

Characters.—Larger cheek-teeth of a combined trenchant and crushing type, the last upper premolar and first lower molar strongly differentiated as carnassials, the former 3-rooted, its inner lobe in front of middle of crown, its position, somewhat posterior to level of anteorbital foramen, at point of greatest mechanical efficiency; auditory bulla moderately or considerably inflated, without septum; form rather light, the legs long; size moderate; feet digitigrade; toes, 5–4 or 4–4.

Remarks.—Notwithstanding its wide distribution the family *Canidæ* is not rich in genera. About a dozen are now recognized, three of which occur in Europe.

KEY TO THE EUROPEAN GENERA OF *CANIDÆ*.

Interorbital region distinctly elevated; postorbital processes convex above; pupil of eye round..... *Canis*, p. 304.
Interorbital region not elevated; postorbital processes not convex above; pupil of eye elliptical.
Postorbital processes flat or very slightly concave above; forehead rising abruptly above level of rostrum; ear rounded..... *Alopex*, p. 318.
Postorbital processes distinctly concave above; forehead rising gradually above level of rostrum; ear pointed *Vulpes*, p. 325.

Genus **CANIS** Linnæus.

1758. *Canis* Linnæus, Syst. Nat., I, 10th ed., p. 38 (type by tautonymy *C. familiaris*).
1816. *Lupus* Oken, Lenrb. d. Naturgesch., III, pt. 2, p. 1039 (*Canis lupus*, by tautonymy).
1837. *Vulpicanis* Blainville, Ann. Sci. Nat., Paris, 2nd ser., Zool., VIII, p. 279, November, 1837 (*Canis aureus* Linnæus).
1839. *Lyciscus* H. Smith, Jardine's Naturalists' Library, Mammals, IX, p. 160 (*Canis latrans* Say).
1839. *Thous* H. Smith, Jardine's Naturalists' Library, Mammals, IX, p. 193 (*Canis anthus* F. Cuvier).
1839. *Sacalius* H. Smith, Jardine's Naturalists' Library, Mammals, IX, p. 213 (*Canis aureus* Linnæus).
1841. *Oxygous* Hodgson, Calcutta Journ. Nat. Hist., II, p. 213 (*Canis aureus* Linnæus).
1857. *Canis* Blasius, Säugethiere Deutschlands, p. 177.
1868. *Neocyon* Gray, Proc. Zool. Soc., London, p. 506 (*Canis latrans* Say).
1869. *Dicba* Gray, Catal. Carn. Pachyd. and Edentate Mamm. Brit. Mus., p. 180 (*Canis anthus* F. Cuvier).

Type species.—*Canis familiaris* Linnæus.

Geographical distribution.—Nearly as in the family, but absent from the Malay Archipelago and South America; in Europe west within historic times to Great Britain, but now restricted to the continent.

Characters.—Skull heavy and deep (depth of brain-case more than one-third condylobasal length); interorbital region thickened and elevated, the frontal sinuses rather large, the postorbital processes thick, convex above, their edges rounded off; dorsal profile of forehead rising rather abruptly and noticeably above level of rostrum; dental formula: $i\frac{3\,3}{3\,3}$, $c\frac{1\,1}{1\,1}$, $pm\frac{4\,4}{4\,4}$, $m\frac{2\,2}{3\,3} = 42$; teeth heavy and large, the length of carnassial and upper molars together contained about $2\frac{1}{2}$ times in palatal length; canines robust and not specially elongated, the point of upper tooth extending scarcely beyond middle of mandibular ramus when jaws are closed (fig. 65).

Remarks.—Much uncertainty exists at present with regard to the limits of the genus *Canis*. As here defined the group includes the domestic dogs, the true wolves, the American prairie

wolves, and the Old World jackals. Two species are known to occur in Europe, one of which is represented by several geographical races.

KEY TO THE EUROPEAN FORMS OF *CANIS*.

Condylobasal length of skull less than 200 mm.; teeth not so large as in the largest domestic dogs (length of upper carnassial 17 to 18 mm.); cingulum on outer margin of m^1 broad and conspicuous (South-eastern Europe; Jackal)..... *C. aureus*, p. 315.

Condylobasal length of skull more than 200 mm.; teeth larger than in the largest domestic dogs (length of upper carnassial 25 to 27 mm.); cingulum on outer border of m^1 narrow, tending to be incomplete at middle (Distribution general; true Wolves)..... *C. lupus*, p. 305.

Size rather small (exact dimensions unknown) (Southern Spain)..... *C. l. deitanus*, p. 315.

Size large.

White of throat not extending uninterruptedly on to cheek (Central and northern Europe) ... *C. l. lupus*, p. 313.

White of throat extending uninterruptedly on to cheek (Spain except extreme south)..... *C. l. signatus*, p. 314.

CANIS LUPUS Linnæus.

(Synonymy under subspecies.)

Geographical distribution.—Originally throughout Europe from Ireland eastward and across Asia, now exterminated in the British Islands, Holland and Denmark.

Diagnosis.—Condylobasal length of skull more than 200 mm. (220 to 255 mm.); cheek-teeth larger than in the largest races of domestic dogs, the upper carnassial 25 to 27 mm. in length, but structure not peculiar, the upper molars with narrow, inconspicuous cingulum on outer side (fig. 61).

External characters.—General form essentially as in domestic dogs of the "collie" type. Ear moderately long, erect, somewhat pointed, extending about to eye when laid forward. Muzzle pad completely bare. Fore foot with third and fourth digits sub-equal and longest, second and fifth shorter, the large pad-like balls fitting closely between those of third and fourth and the slightly trilobed, heart-shaped main pad, the combined area of balls of digits greater than that of pad; thumb much shorter than other digits, the nail smaller, but not peculiar in form, its extremity not reaching level of posterior border of main pad, its ball scarcely indicated, no pad at its base; wrist pad single, near outer side, its area somewhat more than half that of ball of toes. Hind foot essentially like fore foot, but hallux and posterior pad absent. Claws robust, slightly curved, sub-equal throughout. Pads and balls narrowly edged with short hair.

Colour.—General colour of upper parts, tail, and outer surface of legs yellowish brown or buff, darker along median region of

back, on posterior portion of head and outer surface of ears, lighter and more inclined toward greyish at sides of shoulders and between ears and eyes ; longer hairs of back and sides black-tipped, producing an evident dark shading over middle of back,

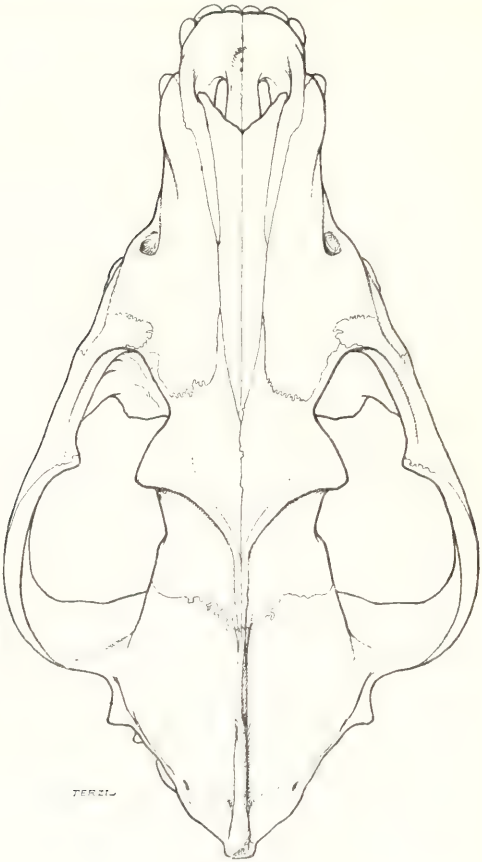

FIG. 58.
Canis lupus. × ½.

especially behind middle and at base of tail ; pencil narrowly clear black, rest of tail essentially like back. Underparts and inner surface of legs pale buff or buffy white, not strongly contrasted with sides, the chin and interramia usually grizzled,

frequently margined with blackish ; upper lip to muzzle pad and including lower half of cheek dull whitish, usually not very different from throat ; inner surface of ear light buff.

Skull.—In general aspect the skull differs slightly if at all

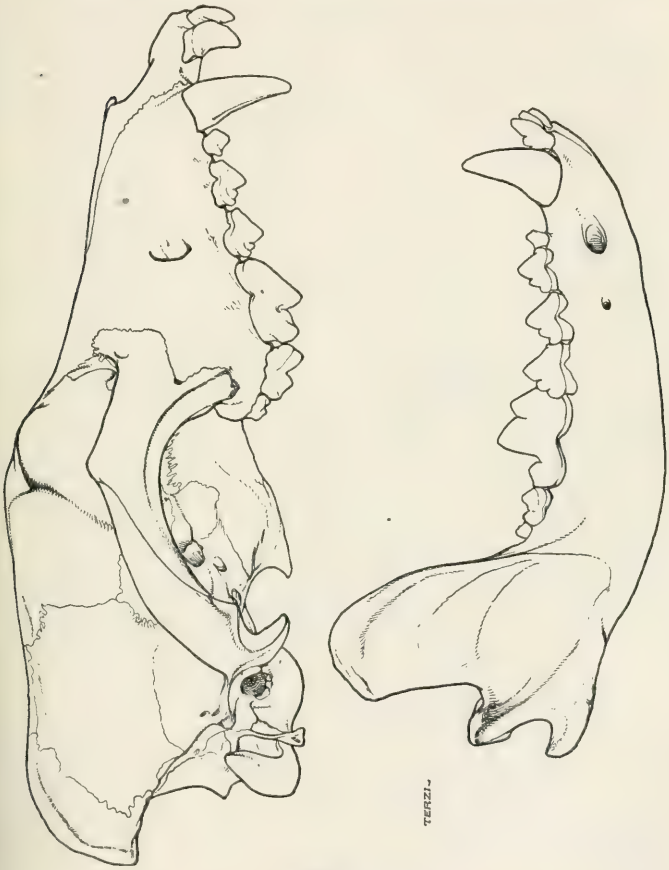

FIG. 59.
Canis lupus. × ½.

from that of some of the larger races of domestic dogs, though often attaining a greater size. The rostrum, however, appears to be relatively less robust than in dog skulls of approximately the same length. Dorsal profile rising gradually from nares to

just in front of orbit, then abruptly to a little in front of bregma, behind which it is nearly flat to strongly overhanging lambdal region. Depth of brain-case through auditory bulla about 2½

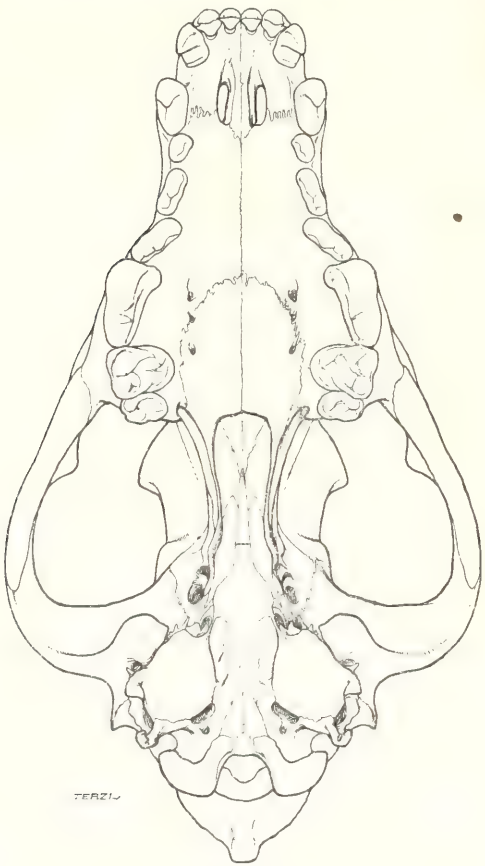

FIG. 60.
Canis lupus. × ½.

times that of rostrum behind canine, and about equal to mastoid breadth. Brain-case rather elongate ovate in outline when viewed from above, its breadth above roots of zygomata about 1½ times that of rostrum over canines and approximately equal

to distance from bregma to most posterior point of occiput. Posterior portion of occiput strongly concave when viewed from the side, the condyles nearly hidden beneath the projecting lambdal region. Floor of brain-case with no specially noteworthy features, the auditory bullæ sub-circular in outline, with short but evident meatal tube, their surface evenly inflated (more so than usual in domestic dogs) except for an evident flattening on antero-external aspect. Sagittal and lambdoid crests well developed, the former dividing just in front of bregma into two ridges curving outward to form posterior border of postorbital processes. Interorbital region moderately elevated, well defined, with distinct longitudinal concavity between raised and thickened postorbital processes. Zygomata widely spreading, the greatest zygomatic breadth (at level of anterior glenoid edge) a little more than half greatest length of skull; orbital process well developed, the orbit surrounded by bone through about four-fifths of its circumference. Rostral breadth at canine about equal to depth at front of carnassial; premaxillary extending posteriorly to about middle of nasal; maxillary extending back nearly to middle of orbit, slightly exceeded by nasal; anteorbital foramen about 9×5 mm. in diameter, over posterior root of third premolar. Palate moderately wide, nearly flat, not extending posteriorly beyond level of last molar, terminating in an obscure median spine; incisive foramina between canines, 11 to 17 mm. in length, their combined breadth usually a little less; mesopterygoid fossa rather more than one-third as long as palate, considerably narrower posteriorly than anteriorly. Mandible strong, but not remarkably robust, the depth at posterior edge of carnassial contained about six times in length; symphysis rather long; coronoid process high, the depth of mandible through its middle noticeably greater than distance from last molar to back of condyle; angular process heavy, nearly horizontal, distinctly raised above level of under margin of ramus.

Teeth.—The teeth are relatively larger than in any of the races of domestic dogs, though in form they show no tangible features by which they may be distinguished. Upper incisors forming a continuous, slightly convex row, the outer tooth separated from canine by a distinct space; size, when viewed from in front, increasing regularly from first to third, but third abruptly much larger than the others in cross-section and nearly half the size of canine; anterior surface of i^1 and i^2 slightly more than half as wide as high, smoothly rounded off, the cutting edge narrow but not acute; a small but distinct secondary lobe at each side of front aspect, that of inner side a little below middle, that of outer side about equally above; posterior surface of crown concave longitudinally though without backward-projecting basal shelf; a well developed median longitudinal rib, and a low but noticeable cingulum, the latter terminating abruptly and forming the lobes seen in front view; outer incisor with no secondary

lobes, its general form intermediate between that of canine and of inner incisors. Lower incisors forming continuous row between canines, the three teeth essentially alike in form, but increasing

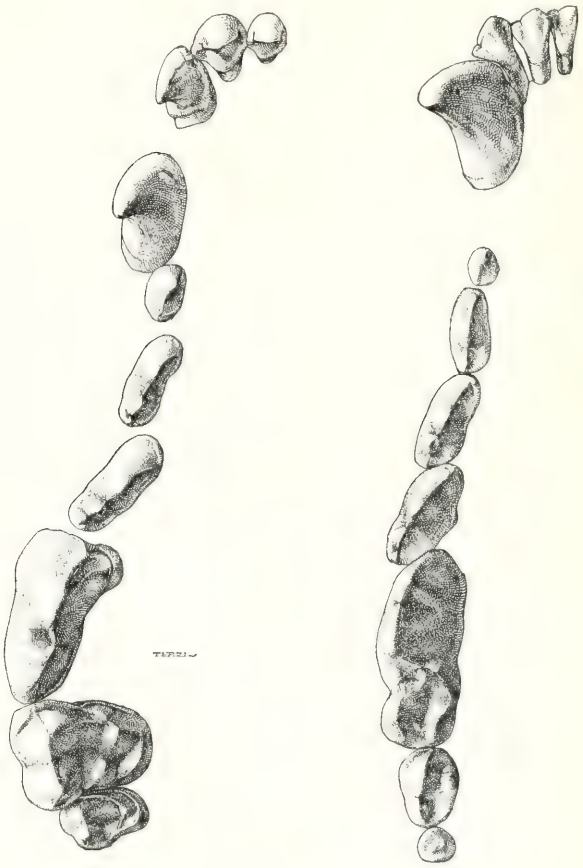

FIG. 61.

Canis lupus. Teeth nat. size.

regularly in size from first to third though less conspicuously than in the case of the upper incisors; crowns (viewed from in front) about twice as high as wide, distinctly bilobed, the outer

lobe scarcely half as wide as inner ; on inner tooth the outer lobe is nearly level with cutting edge, on second it lies slightly above middle of crown, and on third slightly below middle of crown ; posterior surface oblique, slightly concave, with noticeable longitudinal furrow extending back from notch between lobes. Canines large, usually 15 mm. or more in diameter at alveolus and about twice as long, a size rarely if ever attained in domestic dogs, their surface smooth except for a low antero-internal and posterior-median logitudinal ridge, the upper teeth slightly longer and less recurved than the lower. Premolars moderately spaced except that pm^3 is nearly or quite in contact with the carnassial ; first, second and third teeth essentially alike in the two jaws, those of the mandible, however, slightly the less robust ; first premolar both above and below single-rooted, the crown simple, that of pm_1 subterete, that of pm^1 nearly twice as long as broad, the height in both slightly less than length, the crown area approximately the same as that of corresponding inner incisor, the small cusp a little in front of middle and with slightly developed anterior and posterior ridge. Second and third premolars two-rooted, the crown about twice as long as wide, sub-elliptical in outline, the inner margin sometimes (especially in pm_3 and pm^2) slightly concave, the long axis nearly parallel with sagittal plane except in pm^3, which is obliquely set; main cusp a little in front of middle of crown, its height distinctly more than half length of crown, its anterior and posterior cutting ridge well developed, the posterior bearing a distinct secondary cusp situated over middle of posterior root and relatively larger in lower than in upper teeth ; a slight shelf-like projection behind secondary cusp ; pm_4 similar to pm_3 but considerably larger, its secondary cusp better developed and succeeded by a small but evident postero-basal cusp springing from the posterior edge of crown ; cingulum of all the smaller premolars complete though low and inconspicuous. Upper carnassial large and robust, the length of crown along middle slightly more than twice greatest breadth exclusive of antero-internal lobe, the main axis of the tooth extending evidently through middle of crown, so that the small, cuspless inner lobe stands as an offset, slightly breaking the symmetry of the outline ; main cusp slightly behind middle of crown, its height more than half length of tooth, its axis slanting distinctly backward, its anterior and outer surfaces evenly convex except for the rudimentary longitudinal ridge on basal two-thirds of front, its inner surface, together with that of posterior cusp, flattened ; posterior cusp low and robust, obscured by its very high nearly horizontal commissure which meets the somewhat shorter but equally trenchant commissure of main cusp at an angle of about 75° ; cingulum complete, though low and inconspicuous. Lower carnassial narrower than upper but with equally high crown, the most elevated portion in front of middle instead of behind it ; protoconid large and robust, resembling main cusp

of upper carnassial, but with well developed cutting edge both in front and behind ; paraconid near middle of anterior portion of crown ; its general form like posterior cusp of upper carnassial, its commissure bearing essentially the same relation to that of protoconid as in the case of the two cusps of the upper tooth, except that the relative lengths of the cutting edges is reversed ; metaconid small but evident, at postero-internal base of protoconid ; hypoconid and entoconid low, occupying the posterior edge of a well developed though relatively small heel (area of heel scarcely more than one-third that of anterior portion of tooth) separated from the cusps of the main triangle by a wide transverse groove ; crown area of entoconid equal to about half that of hypoconid, its cusp approximately the same size as that of metaconid. Second lower molar essentially like heel of carnassial but larger, its two anterior cusps corresponding in size and form with hypoconid and entoconid of the large tooth, the posterior edge of its crown with a small outer cusp resembling the antero-inner, and sometimes with a slightly developed inner ridge or rudimentary fourth cusp. Third lower molar single-rooted, the crown subterete, about as large as that of first premolar, with low central cusp and rudimentary longitudinal ridge. First upper molar large, with high outer two-cusped sectorial portion and low inner crushing portion, the two areas sharply differentiated, the antero-posterior diameter of the outer decidedly greater than that of inner ; paracone and metacone conical, terete, with slightly developed anterior and posterior cutting ridges, the area and height of metacone about two-thirds those of paracone, the width of base of which is at least equal to width of inner portion of tooth ; protocone very low, with low but distinct anterior and posterior commissures, each of which joins cingulum at base of corresponding large outer cusps, and each of which bears an intermediate cusp soon disappearing with wear, the posterior intermediate cusp larger and more definite in form than anterior cusp ; hypocone ridge-like, at postero-inner border of crown, separated from protocone and its posterior commissure by a deep groove. Second upper molar with about half the crown area of first, its elements essentially the same, though so reduced that the paracone is scarcely larger than protocone of large tooth, intermediate cusps on commissures of protocone are barely indicated, and hypocone is not distinguishable as a cusp distinct from the cingulum. In both molars the cingulum on outer border is narrow and inconspicuous relatively to the broad cusps ; in region between paracone and metacone of m^1 it is usually obsolete (compare figs. 61 and 62).

Remarks.—The material available for study has been so poor that I have found it impossible to come to any conclusion with regard to the existence of local forms of the European Wolf. The following races have been distinguished by Mr. Cabrera. There seems to be no good reason to doubt their validity.

The only known characters by which the skull of *Canis lupus* can be distinguished from that of the larger domestic dogs is the greater average general size and the relatively larger teeth. In a dog's skull with condylobasal length of 230 mm. the length of upper and lower carnassials is respectively 21·6 and 25·0 mm. In ten skulls with condylobasal length of more than 200 mm. the average and extremes for these teeth are: upper, 20·5 (19–22); lower, 24·0 (22·8–26·0).* In all the dog skulls which I have examined, representing such different breeds as the pug, fox-terrier, bloodhound, mastiff, ancient Egyptian, ancient Peruvian, Eskimo (Greenland and Alaska) and American Indian, the teeth are strictly of the wolf type, never showing any approach to that of the jackal (fig. 62).

Canis lupus lupus Linnæus.

1758. [*Canis*] *lupus* Linnæus, Syst. Nat., I, 10th ed., p. 39 (Sweden).

1792. *C*[*anis*] *lupus flavus* Kerr, Anim. Kingd., p. 137 (France and Germany).

1804. *Canis lupus niger* Hermann, Observ. Zool., p. 32. Not of Kerr, 1792 (Forest of Hagenau, Alsace, Germany).

1839. ? [*Canis lupus*] var. *canus* de Sélys-Longchamps, Études de Micromamm., p. 144 (nomen nudum).

1839. ? [*Canis lupus*] var. *fulvus* de Sélys-Longchamps, Études de Micromamm., p. 144 (nomen nudum).

1841. *Lupus orientalis* Wagner, Schreber's Säugthiere, Suppl., II, p. 367 (Europe).

1857. *Canis lupus* Blasius, Säugethiere Deutschlands, p. 180.

1863. [*Canis lupus*] var. *major* Ogérien, Hist. Nat. du Jura, III, p. 59 (Lower slopes of the Jura).

1863. [*Canis lupus*] var. *minor* Ogérien, Hist. Nat. du Jura, III, p. 69 (Higher portions of the Jura).

1897. *Canis lupus minor* Mojsisovics von Mojsvár, Thierleben der osterr.-hung. Tiefebenen, p. 241 (Southern Hungary). Based on the "Rohrwolf," an animal supposed to be smaller and greyer than true *lupus*.

1910. *Canis lupus* and *C. lupus lycaon*† Trouessart, Faune Mamm. d'Europe, p. 90.

Type locality.—Sweden.

Geographical distribution.—Northern and central Europe, exact limits of range unknown; formerly west to Ireland.

Characters.—Size maximum for the species; general colour

* Winge (Danmarks Fauna, Pattedyr, p. 123, 1908) states that in the skull of a dog from a prehistoric grave (Iron Age) in Denmark, the length is 209, and that of the two carnassials 20 and 22·5 respectively, while in a rather large modern "great Dane" the corresponding measurements are 255, 22 and 28. This author (p. 124) regards the domestic dogs as derived from *Canis aureus*.

† Applied to the wolf of the Pyrenees; but Schreber's plate LXXXIX, the basis of the name, is a copy of Buffon's plate XLI, representing an animal brought alive to Paris from Canada.

not markedly tawny ; white of throat not extending to cheeks. The few skulls examined agree with Asiatic specimens in having the outer cusps of m^1 moderately large, the paracone with transverse diameter of base about equal to width of large flattened portion of crown.

Measurements.—For cranial measurements see Table, p. 316.

Specimens examined.—Four skulls, from the following localities:—
Sweden: No exact locality, 2 (U.S.N.M.).
Russia: No exact locality, 1 (U.S.N.M.).
Italy: Near Sassello, Liguria, 1 (Genoa).

Canis lupus signatus Cabrera.

1907. *Canis lupus signatus* Cabrera, Bol. Real Soc. Españ. Hist. Nat., Madrid, vii, p. 195.
1910. *Canis lupus signatus* Trouessart, Faune Mamm. d'Europe, p. 91.

Type locality.—Escorial, Madrid, Spain.
Geographical distribution. Central Spain.
Characters. Size and general appearance as in *Canis lupus lupus;* colour a more tawny brown than in the northern animal, particularly on muzzle ; white of throat extending uninterruptedly to cheeks.*

Measurements.—Type (adult male), from Cabrera: head and body, 1230 ; tail, 400 ; hind foot, 265 ; ear, 125. Young adult male and female from Province of Burgos, Spain: head and body, 1130 and 1180 ; tail, 350 and 380 ; hind foot, 225 and 220 ; ear 120 and 115. For cranial measurements see Table, p. 316.

Specimens examined.—One from Seville, Spain, and two from Province of Burgos, Spain.

Remarks.—In dentition the Seville specimen differs from all the other Old World wolves with which I have compared it in the unusual development of the outer cusps of the upper molars. The transverse diameter of paracone in m^1 conspicuously exceeds width of the small inner portion of tooth. Mr. Cabrera informs me that the type shows much the same peculiarities. This character is also present, though less pronounced, in the two skulls from Burgos, which further differ from northern specimens in the smaller size and more globular form of the auditory bullæ.

♂.	Seville, Spain. (*A. Ruiz.*)	Lord Lilford (p).	95. 3. 3. 6.
♂, ♀.	Riocabado, Burgos. (*Rev. S. Gonzalez.*)	Hon. N. C. Rothschild (p).	11. 10. 5. 1–2.

* In the Burgos specimens the colour is not unusually tawny: back and sides a coarse mixture of black, whitish, ochraceous-buff, and drab grey (underfur), the black and whitish most conspicuous along back, the ochraceous-buff on legs and feet (clear and unmixed on latter); ear ochraceous-rufous on outer side (darker and duller at tip), pallid ochraceous-buff on inner surface; throat and lower half of cheeks the same pallid ochraceous-buff; chin and interramia blackish.

Canis lupus deitanus Cabrera.

1907. *Canis lupus deitanus* Cabrera, Bol. Real Soc. Españ. Hist. Nat., Madrid, VII, p. 197.
1910. *Canis lupus deitanus* Trouessart, Faune Mamm. d'Europe, p. 91.

Type locality.—Moratalla, Murcia, Spain.

Geographical distribution.—Now known from the type locality only.

Diagnosis.—Smaller than *Canis lupus lupus* and brighter in colour, the general appearance much as in *C. aureus*.

Measurements.—Unknown.

Specimens examined.—I have seen the two living examples in Madrid on which the form was based.

Remarks. In general appearance the two Moratalla wolves are strikingly different from *Canis lupus*. Unfortunately their true characters are not yet known.

CANIS AUREUS Linnæus.

1758. [*Canis*] *aureus* Linnæus, Syst. Nat., I, 10th ed., p. 40.
1835. *Canis aureus* var. *moreotica* I. Geoffroy, Expéd. Sci. de Morée. Zool., pl. I (Morea, Greece).
1841. *C*[*anis*] *dalmatinus* Wagner, Schreber's Säugthiere, Suppl., II, p. 383 (Dalmatia).
1841. *C*[*anis*] *græcus* Wagner, Schreber's Säugthiere, Suppl., II, p. 383 (Peloponesus).
1892. *Canis aureus balcanicus* Brusina, Glasnik Hrvatskoga Naravoslovnoga Društva, Zagreb, VII, p. 317 (Drava River, Croatia).

Type locality.—Province of Lar, Persia.

Geographical distribution.—India and westward through Asia Minor to the Balkan Peninsula, north to Heves Comitat, Hungary.

Diagnosis.—Smaller than *Canis lupus* (condylobasal length of skull less than 200 mm.); teeth not equal to those of the larger domestic dogs in size, the upper molars with wide, conspicuous cingulum on outer side (fig. 62).

Colour.—Upper parts buffy cinnamon, clouded by black hair tips along dorsal region, nearly clear on sides, and becoming clear bright cinnamon on outer surface of legs and ear and on area around and behind base of ear; muzzle more heavily washed with black; from middle of back to base of tail the cinnamon is replaced by whitish, causing a rather noticeable contrast between this region and the surrounding parts when fur is disarranged; tail essentially like back, the basal half above greyish, the terminal half and underside buffy much overlaid with black; pencil blackish; underparts and inner side of legs dull buffy grey; chin blackish; feet dull buffy.

CRANIAL MEASUREMENTS OF *CANIS LUPUS* AND *C. AUREUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Mastoid breadth.	Postorbital constriction.	Interorbital constriction.	Rostral breadth over canine.	Depth of brain-case (crest excluded).	Palatal depth behind tooth-row.	Rostral depth behind canine.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.	
C. lupus lupus.																
Sweden . . .	1035 U.S.N.M.	♂ ?	255·0	145·0	88·0	41·4		52·0		65·0	36·0	198·0	109·0	126·0	Basal suture	closed.
Northern Sweden .	1037 ,,	♀ ?	232·0	141·0	80·4	42·4	49·4	48·0	—	72·0	33·0	182·0	100·0	116·0	,,	,,
Russia . . .	910 ,,	♀ ?	—	135±	–	—	40·0	44·0	—	—	36·4	186·0	101·0	113·0	,,	?
Italy: near Sassello, Liguria .	Genoa	♂	235·0	132·0	78·0	40·4	44·0	45·0	63·0	58·6	34·0	184·0	101·0	117·0	,,	closed.
C. lupus signatus.																
Spain: near Seville	95. 3. 3. 6	♂	221·0	126·0	81·4	44·0	42·0	46·0	64·4	66·0	31·0	175·4	97·0	112·0	,,	open.
Prov. Burgos	11. 10. 5. 1.	♂	234·0	132·0	80·0	46·6	44·0	45·4	65·4	63·0	34·6	184·0	104·4	120·4	,,	,,
,, ,,	11. 10. 5. 2.	♀	226·0	121·0	78·6	43·2	41·4	42·6	62·8	61·6	32·0	179·0	101·6	115·0	,,	,,
C. aureus.																
Greece: Piræus .	8. 10. 2. 50		158·0	83·0	55·2	31·2	26·4	29·2	49·2	40·4	22·4	121·2	68·4	78·4	,,	,,
Asia Minor: Khotz	6. 5. 1. 31	♂	157·0	87·2	54·4	31·2	31·0	30·4	50·2	43·6	24·0	120·4	67·6	77·2	,,	closed.
,,	6. 5. 1. 33	♀	151·4	84·0	54·2	26·0	25·8	27·4	46·2	40·4	21·8	115·4	67·0	76·2	,,	,,
,,	6. 5. 1. 34	♀	148·0	87·8	54·4	30·2	27·6	29·8	47·4	40·2	21·2	114·6	65·6	73·8	,,	,,
,,	6. 5. 1. 35	♀	148·6	85·4	55·2	30·6	25·2	27·6	46·8	40·0	18·8	115·6	65·2	74·6	,,	,,

DENTAL MEASUREMENTS OF *CANIS LUPUS* AND *C. AUREUS*.

Locality.	Number.	Sex.	Upper carnassial.	First upper molar.	Lower carnassial.
C. lupus lupus.					
Sweden	1035 U.S.N.M.	♂?	27·0 × 13·2	18·0 × 22·0	30·4 × 12·2
Northern Sweden	1037 ,,	♀?	25·8 × 13·0	15·8 × 21·6	28·0 × 11·2
Russia	910 ,,	♀?	24·8 × 11·0	16·0 × 19·0	27·4 × 11·0
Italy: near Sassello, Liguria	Genoa	♂	26·0 × 14·4	15·6 × 21·4	29·6 × 11·8
C. lupus signatus.					
Spain: near Seville	95. 3. 3. 6	♂	25·0 × 13·0	16·2 × 20·0	27·0 × 10·8
Prov. Burgos	11. 10. 5. 1.	♂	27·2 × 13·2	17·0 × 23·2	30·6 × 12·2
,, ,,	11. 10. 5. 2.	♀	25·4 × 13·0	16·0 × 21·4	28·0 × 11·8
C. aureus.					
Greece: Piræus	8. 10. 2. 50		17·8 × 9·0	12·2 × 15·4	18·6 × 7·0
Asia Minor: Khotz	6. 5. 1. 31	♂	17·8 × 9·0	12·2 × 15·4	18·6 × 7·0
,,	6. 5. 1. 33	♀	17·2 × 9·4	12·8 × 15·8	18·8 × 7·2
,,	6. 5. 1. 34	♀	17·0 × 8·2	12·6 × 15·4	18·0 × 7·0
,,	6. 5. 1. 35	♀	17·0 × 8·2	12·2 × 15·2	18·4 × 7·2

Skull.—The skull is much smaller than that of *Canis lupus*. In form it differs slightly in the less elevated frontal region and somewhat more inflated auditory bullæ.

Teeth. While agreeing with those of *Canis lupus* in general form and in the position of the cusps, the teeth are on the whole more trenchant in character, as shown by the general tendency toward narrowness of crown and prominence of ridges. This is particularly noticeable in the upper molars, in which the large cusps are relatively higher, more slender, and less terete than in *Canis lupus*, their cutting ridges much more developed; transverse diameter of metacone in m^1 noticeably less than width of inner portion of crown; cingulum on outer border of both upper molars wide and conspicuous in contrast with narrow cusps, showing no tendency to become obsolete in region between paracone and metacone. Lower carnassial with metaconid actually as well as relatively larger than in *Canis lupus*, and posterior heel with area equal to nearly half that of anterior portion of tooth, its cusps strongly developed.

FIG. 62.
Canis aureus.
Larger maxillary cheek-teeth.
Nat. size.

Measurements.—For cranial measurements see Table, p. 316.

Specimens examined.—One from Greece (Piræus); numerous others from Asia Minor and India.

Remarks.—The single specimen from Greece agrees sufficiently with a series of five from Khotz, near Trebizond, Asia Minor, to make it appear unwise, in the absence of more satisfactory material, to use one of the Balkan names.

1. Piræus, Greece. (*C. Mottaz.*) Hon. N. C. Rothschild (P). 8. 10. 2. 49-50.

Genus **ALOPEX** Kaup.

1829. *Alopex* Kaup, Entw.-Gesch. und Natürl. Syst. Europ. Thierw., I, p. 83.
1857. *Leucocyon* Gray, Proc. Zool. Soc., London, p. 512.

Type species.—*Canis lagopus* Linnæus.

Geographical distribution.—Arctic region of both Old and New Worlds; in Europe south to southern Norway and Sweden.

Characters.—Skull intermediate in general form between that of *Canis* and *Vulpes*; occipital depth about one-third condylobasal length; interorbital region more elevated than in *Vulpes* owing to greater inflation of the frontal sinuses; postorbital processes thin, flat or slightly concave above, with bead-like, overhanging edges; dorsal profile of forehead rising abruptly

above rostrum as in *Canis*; teeth moderately heavy and large, the length of carnassial and upper molars together contained about $2\frac{3}{4}$ times in palatal length; canines and incisors intermediate between those of *Canis* and *Vulpes* (see fig. 65); external form fox-like, but ear short and rounded, not conspicuously overtopping the surrounding fur.

Remarks.—Although in most respects intermediate between *Canis* and *Vulpes* the Arctic foxes form such a natural and circumscribed group that it seems desirable to set them apart as a distinct genus.* Half a dozen species have been described, two of which come within the scope of the present work.

KEY TO THE EUROPEAN SPECIES OF *ALOPEX*.

Condylobasal length of skull about 130 in males,
124 in females (Scandinavia and Finland)... *A. lagopus*, p. 319.
Condylobasal length of skull about 120 in males,
114 in females (Spitzbergen)..... *A. spitzbergenensis*, p. 324.

ALOPEX LAGOPUS Linnæus.

1758. [*Canis*] *lagopus* Linnæus, Syst. Nat., I, 10th ed., p. 40 (Lapland).
1816. *V*[*ulpes*] *arctica* Oken, Lehrb. d. Naturgesch., III, pt. 2, p. 1033 (Renaming of *Canis lagopus*).
1820. *C*[*anis*] *vulpes cærulea* Nilsson, Skand. Fauna, I, p. 88 (Lapland).
1827. [*Canis lagopus*] *β argenteus* Billberg, Synopsis Faunæ Scandinaviæ, p. 14 (Lapland).
1910. *Vulpes lagopus* Trouessart, Faune Mamm. d'Europe, p. 96.

Type locality.—Lapland.

Geographical distribution.—Arctic portions of the mainland of Europe and Asia; in Europe south along the mountains of Scandinavia to south-western Norway, and as an occasional visitant as far as southern Sweden.

Diagnosis.—General characters as in the genus; condylobasal length of skull about 130 mm. in males, about 124 mm. in females.

External characters.—In general external characters *Alopex lagopus* resembles *Vulpes vulpes*, though the muzzle is less elongated, and the low, rounded ears (not extending to eye when laid forward) impart a somewhat un-fox-like appearance to the head. Fur very dense, the underfur in summer about 12 mm. deep on back, nearly twice as deep and somewhat looser in texture on sides (in winter longer throughout); longer hairs rather sparse, not concealing underfur. Tail bushy, with abundant underfur. Feet as in *Canis*, but claws longer and more slender, and entire palm and sole covered with a dense woolly growth of hair, 15–17 mm. deep in winter, shorter in

* See Collett, Norges Pattedyr, p. 275, 1911, for account of apparently complete sterility of Arctic fox male with Red fox female, a fact which indicates a fundamental physiological difference between the two animals.

summer when it sometimes wears away sufficiently to expose balls of toes, and parts of pads.

Colour.—Summer pelage: ground colour of back, shoulders, and outer side of legs drab, darkening to about prout-brown or

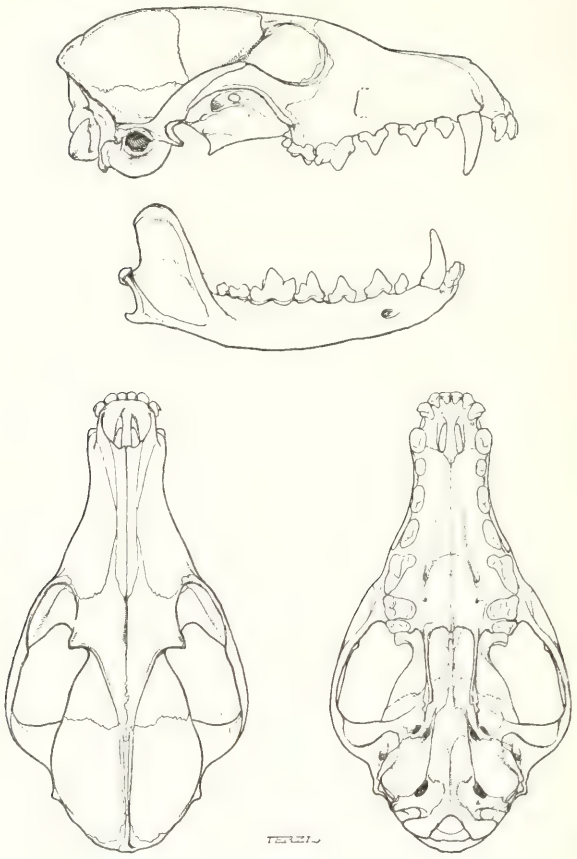

FIG. 63.
Alopex lagopus. × ½.

dark bister on feet, head, chin, interramial region and outer surface of ears, the face thickly sprinkled with whitish hairs, especially on cheeks and between eyes, the interramial region tinged with slaty grey; each of the longer hairs of back with

one cream-buff sub-terminal annulation, producing a noticeably speckled appearance throughout dark area; flanks with a few long, entirely buff hairs; sides of body and of neck light cream-buff tinged with clay-colour, in striking contrast with dark areas, the buff lateral area divided at shoulder by band about 60 mm. wide where drab of back crosses to leg; anteriorly the buff lateral area extends to about level of ears where it abruptly gives place to dark brown of head; inner surface of ear light buffy grey; underparts and inner surface of legs buffy greyish, slightly contrasted with sides; under surface of tail like sides of body, upper surface essentially like back at base (where line of demarcation is well defined), but becoming tinged with buffy toward tip. Winter pelage: entirely white, tinged with yellowish on throat, neck and face; underfur and posterior surface of ear light drabby grey. In the "blue" phase the entire animal is at all seasons a bluish drab, usually washed with sepia on head and feet, and sprinkled with pure white hairs on face, chin and throat.

Skull.—The skull is shorter and narrower than that of *Vulpes vulpes*, but of nearly equal depth, a difference in form due in part to the greater elevation of the interorbital region and in part to the relatively greater depth of brain-case (depth equal to one-third condylobasal length instead of noticeably less as in *V. vulpes*); muzzle less produced than in the common fox and relatively wider proximally; zygomata less abruptly spreading anteriorly, so that the region of greatest zygomatic breadth is noticeably at glenoid level. In other respects there is essential agreement with the skull of *V. vulpes*. Anteorbital foramen over space between pm^3 and pm^4; auditory bulla relatively as large as in the larger animal; depth of brain-case through bulla equal to greatest breadth above roots of zygomata; postorbital processes slightly less concave on underside and somewhat more flattened above; mandible with ramus relatively a little deeper and more compressed than in the common fox.

FIG. 64.
Alopex lagopus. Teeth. Nat. size.

Teeth.—In general the teeth closely resemble those of *Vulpes vulpes* except for their slightly smaller size. Incisors both above and below with relatively wider crowns than in the common fox, the cingulum of i^1 and i^2 much more developed and forming a

CRANIAL MEASUREMENTS OF *ALOPEX LAGOPUS* AND *A. SPITZBERGENENSIS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Mastoid breadth.	Interorbital breadth.	Rostral breadth over canines.	Depth of brain-case.	Palatal depth behind tooth-rows.	Rostral depth behind canine.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
A. lagopus.														
Norway: Röros	95. 11. 14. 1	♀	120·6	66·2	41·0	28·2	22·0	38·6	33·6	16·6	90·0	54·6	59·8	Teeth not worn.
Dovre	95. 11. 14. 2	♀	121·0	66·4	41·4	25·6	22·2	37·4	33·0	15·2	91·4	54·8	60·4	,, slightly worn.
Egersund.	11. 6. 3. 12		127·4	69·4	42·6	31·0	24·0	42·2	36·0	17·8	98·0	59·4	62·6	
Sweden: no exact locality	1039 U.S.N.M.		124·0	70·2	41·4	26·6	23·6	38·0	32·4	17·6	96·2	54·8	62·0	,, ,,
Lapland: ,,	64. 3. 8. 3	♀	123·6	64·8	42·6	27·0	22·2	36·4	32·4	17·2	96·0	56·4	63·2	,, ,,
,,	64. 3. 8. 4	♂	130·2	70·8	44·0	28·6	23·2	37·8	35·0	18·0	100·2	59·0	65·0	,, ,,
,,	1040 U.S.N.M.		128·0	70·6	44·0	28·2	22·8	41·4	34·2	18·0	97·4	57·6	64·0	,, ,,
A. spitzbergenensis.														
Spitzbergen	90. 8. 1. 2	♂	119·0	69·6	42·8	26·4	22·8	37·8	32·4	17·4	91·0	52·4	58·0	,, moderately worn.
,,	96. 9. 23. 2	♂	120·2	69·8	44·2	28·0	22±	41·2	33·4	18·0	—	52·6	—	,, ,,
,,	96. 9. 23. 5	♂	122·0	65±	43·0	26·2	24·8	40·4	36·2	18·0	93·4	54·4	60·0	,, slightly worn.
,,	96. 9. 23. 3*	♀	114·0	66·0	41·4	25·2	20·8	38·0	29·8	15·4	85·0	50·4	56·4	,, ,,
,,	96. 9. 23. 4	♀	112·4	63·8	40·0	24·0	21·0	36·4	30·0	14·4	85·4	50·2	56·0	,, ,,

* Type.

DENTAL MEASUREMENTS OF *ALOPEX LAGOPUS* AND *A. SPITZBERGENENSIS*.

Locality.	Number.	Sex.	Upper carnassial.	First upper molar.	Lower carnassial.
A. lagopus.					
Norway: Röros	95. 11. 14. 1	♀	13·8 × 6·8	8·0 × 9·4	13·8 × 5·2
Dovre	95. 11. 14. 2	♀	13·2 × 6·2	8·6 × 9·4	—
Egersund	11. 6. 3. 12		13·2 × 7·2	8·4 × 10·2	15·4 × 5·2
Sweden: no exact locality	1039 U.S.N.M.		13·8 × 6·4	8·2 × 10·0	14·4 × 4·6
Lapland: ,,	64. 3. 8. 3	♀	14·2 × 7·0	9·0 × 9·8	14·8 × 5·0
,,	64. 3. 8. 4	♂	14·2 × 7·2	8·0 × 9·6	13·8 × 5·0
,,	1040 U.S.N.M.		14·0 × 6·2	8·2 × 10·0	14·2 × 4·8
A. spitzbergenensis.					
Spitzbergen	90. 8. 1. 2	♂	13·0 × 6·6	7·6 × 9·2	12·8 × 5·0
,,	96. 9. 23. 2	♂	13·6 × 6·2	8·0 × 9·4	—
,,	96. 9. 23. 5	♂	13·2 × 6·4	8·2 × 9·4	13·2 × 4·6
,,	96. 9. 23. 3*	♀	12·2 × 6·4	7·2 × 8·8	12·6 × 4·6
,,	96. 9. 23. 4	♀	12·8 × 5·6	7·6 × 8·6	12·8 × 4·4

* Type.

noticeable inner and outer secondary cusp (the former soon wearing away in i^1) much as in *Canis;* along posterior border of crown the cingulum shows a strong tendency to develop irregular tubercles, a condition not observed in *Vulpes vulpes.* Canines and premolars with no special peculiarities, the form of the upper carnassial quite as in *V. vulpes.* Lower carnassial with posterior heel narrower than main portion of tooth but not otherwise peculiar. First upper molar with metaconule relatively less developed than in *Vulpes vulpes.*

Measurements.—For cranial measurements see Table, p. 322.

Specimens examined.—Ten, from the following localities:—
NORWAY: Röros, Trondhjem, 1; Tolgen, Hedemarken, 2; Dovre, 2; Egersund, Stavanger, 1.
SWEDEN: No exact locality, 1 skull (U.S.N.M.).
LAPLAND: No exact locality, 3 skulls (B.M. and U.S.N.M.).

♀.	Röros, Trondhjem, Norway.	Christiania Museum (E).	95. 11. 14. 1.
skull.	Egersund, Stavanger.	K. H. Schaanning (C).	11. 6. 3. 12.
2 ♀.	Dovre.	Christiania Museum (E).	95. 11. 14. 2–3.
2 imm.	Tolgen, Hedemarken.	Christiania Museum (E).	93. 3. 1. 1. 0. 5. 2. 1.
2 skulls.	Lapland.	Wheelwright (C).	64. 3. 8. 3–4.

ALOPEX SPITZBERGENENSIS Barrett-Hamilton and Bonhote.

1799. ? *Canis fuliginosus* Bechstein, Thomas Pennant's allgem. Uebersicht d. vierfüss. Thiere, I, p. 270 (Iceland).

1799. ? *Canis groenlandicus* Bechstein, Thomas Pennant's allgem. Uebersicht d. vierfüss. Thiere, I, p. 270 (Greenland).

1898. *Canis lagopus spitzbergensis* Barrett-Hamilton and Bonhote, Ann. and Mag. Nat. Hist., 7th ser., I, p. 287, April, 1898 (Spitzbergen). Type in British Museum.

1910. *Vulpes lagopus spitzbergensis* and ? *V. lagopus fuliginosus* Trouessart, Faune Mamm. d'Europe, p. 97.

Type locality.—Spitzbergen.

Geographical distribution.—Spitzbergen; also Iceland and Greenland?

Diagnosis.—Like *Alopex lagopus* but smaller, condylobasal length of skull about 120 in males, about 114 in females.

Colour.—Type (summer pelage): colour pattern well defined and exactly as in *A. lagopus*, but dark areas wood-brown against which the cream-buff annulations of longer hairs make no marked contrast. Another skin, also in summer pelage, is a uniform dark slaty drab throughout, the hind feet darker and more brown; sides and underparts with a few long white hairs (50 mm.); lips with slight grizzling due to presence of short white hairs.

Measurements.—For cranial and dental measurements see Tables, pp. 322, 323.

Specimens examined.—Six, all from Spitzbergen (B.M. and U.S.N.M.):—

♂ skull.	Spitzbergen.	Stockholm Museum (E).	90. 8. 1. 2.
♂, ♀.	Spitzbergen.	Dr. J. W. Gregory (C & P). (96. 9. 23. 3. *Type* of species.)	96. 9. 23. 2–3.
♂, ♀ skulls.	Spitzbergen.	Dr. J. W. Gregory (C & P).	96. 9. 23. 4–5.

Genus **VULPES** Oken.

1816. *V[ulpes]* Oken, Lehrb. d. Naturgesch., III, pt. 2, p. 1033, in full on p. 1034 and in index, p. 1268 (*Vulpes communis* Oken = *Canis vulpes* Linnæus).

1821. *Vulpes* Bowdich, Anal. Nat. Classif. Mamm., p. 40 (*Canis vulpes*).

1857. *Vulpes* Blasius, Säugethiere Deutschlands, p. 178 (Sub-genus of *Canis*).

Type species.—*Canis vulpes* Linnæus.

Geographical distribution.—Northern portion of the northern hemisphere from about the limit of tree growth south to Morocco, India and Mexico; in Europe west to Ireland.

Characters.—Skull slender and low (depth of brain-case less than one-third condylobasal length); interorbital region nearly flat, the frontal sinuses scarcely inflated, the postorbital processes thin, slightly concave above, their edges overhanging and bead-like; dorsal profile of forehead rising very slightly and gradually above level of rostrum; dental formula as in *Canis;* teeth relatively light and small, the length of upper carnassial and molars together contained about $2\frac{3}{4}$ to 3 times in palatal length, the general character of cheek-teeth somewhat more trenchant than in *Canis*, the canines slender and elongated, the point of upper tooth extending to about level of lower margin of mandibular ramus when jaws are closed (fig. 65).

Remarks.—As thus restricted the genus *Vulpes* contains about thirty-five forms, all peculiar to the northern hemisphere. Five of these occur in Europe.

KEY TO THE EUROPEAN FORMS OF *VULPES*.

Size small, hind foot in adult male about 125 mm., condylobasal length of skull in both sexes less than 130 mm. (Sardinia and Corsica)..... *V. ichnusæ*, p. 336.

Size large, hind foot in adult male 135 to 165 mm., condylobasal length of skull in adult male 135 to 165 mm., in adult female 127 to 155 mm..... *V. vulpes*, p. 326.

Teeth larger and more robust, the premolars tending to be slightly spaced or in contact, their secondary cusps well developed (Scandinavia)... *V. v. vulpes*, p. 330.

Teeth smaller and less robust, the premolars tending to be widely spaced, their secondary cusps usually obsolete or absent.

Yellowish and reddish tints bright; posterior half of back seldom much frosted with whitish; tail never clear grey (Central Europe)..... *V. v. crucigera*, p. 331.

Yellowish and reddish tints pale and dull; posterior half of back usually much frosted with whitish; tail often clear grey (Iberian Peninsula)..... *V. v. silacea*, p. 333.

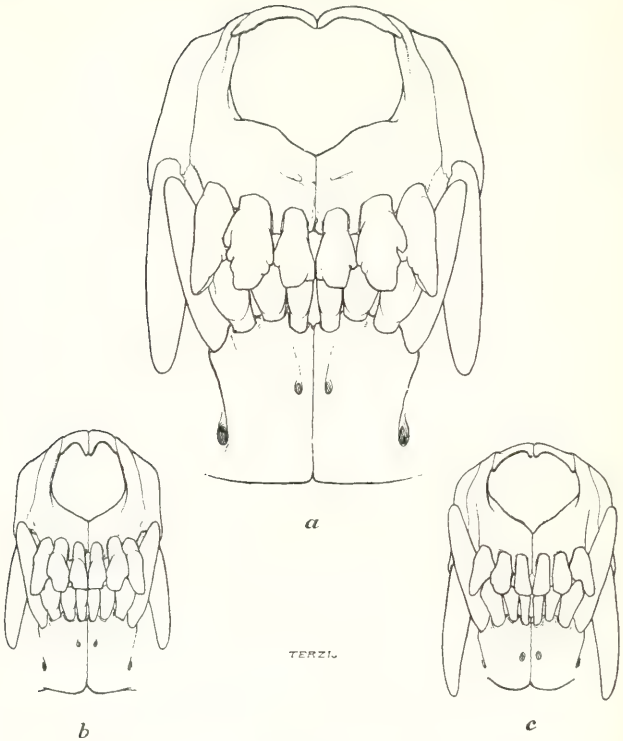

FIG. 65.

Incisors and canines from front, of *Canis* (*a*), *Alopex* (*b*), and *Vulpes* (*c*).

VULPES VULPES Linnæus.

(Synonymy under subspecies.)

Type locality.—Upsala, Sweden.

Geographical distribution.—Europe from the Arctic coast to the Mediterranean, and from Ireland eastward into Asia.

Diagnosis.—Size large: hind foot, in adult male 135 to 165 mm.; condylobasal length of skull in adult male 135 to 165 mm., in adult female 127 to 155 mm.

External characters.—Form more slender and legs relatively shorter than in *Canis;* muzzle long and pointed; ear high, pointed, rising conspicuously above surrounding fur; tail long,

thick and bushy, with abundant underfur; longer hairs of back normally concealing the underfur; feet as in *Canis*, but with the soles hairy between the pads, the pads themselves sometimes furred.

Colour.—General colour a yellowish brown brighter and more inclined toward reddish along median dorsal region and on face, duller and more yellowish or greyish on sides of body to shoulder and on sides of neck to base of ear, the flanks and usually the sides sprinkled with white hairs which may produce a decided effect of frosting; underparts very variable, ranging from whitish to slaty black, rarely almost concolor with sides; feet dusky or blackish; ear tawny or buff at base and on inner surface, the terminal half of outer side black or very dark brown in strong contrast with surrounding parts; upper lip dull white. Blackish and greyish variations not uncommon, especially at the north.

Skull.—General form of skull slender and somewhat flattened, with widely spreading, nearly parallel zygomata. Dorsal profile almost flat from nares to slightly beyond middle of nasal bones, then rising at a slight angle (10° or less) to or a little beyond bregma, behind which it slopes away by an evenly convex curve (distorted in old individuals by the development of the sagittal crest) to lambda, which lies a little above level of middle of orbit; ventral profile essentially straight. Brain-case distinctly broader than high, its outline ovate when viewed from above, the lambdoid and sagittal crests well developed, the latter extending forward about to bregma, where it divides, sending a branch to form posterior border of each postorbital process. Occiput obliquely truncate, so that condyles are not visible from above, but region between lambda and foramen magnum slightly if at all concave. Floor of brain-case with no special peculiarities; auditory bullæ moderately and evenly inflated, slightly flattened antero-externally, meatal tube short but distinctly indicated, especially its hinder wall. Interorbital region flattened, with median longitudinal groove, the postorbital processes prominent, flattened, triangular, much shorter along posterior edge than along antero-external edge, the margin slightly raised so that the upper surface is somewhat concave, the under surface so abruptly concave that the process is much less thick than in *Alopex* and *Canis*. Rostrum moderately long (the distance from orbit to gnathion about equal to that from postorbital process to lambda), rather abruptly narrowed proximally, so that the sides are nearly parallel through a noticeable portion of their extent (occasionally the sides diverge from region of greatest narrowing to bases of canines); nasal slender, narrowing gradually backward and extending nearly to level of middle of orbit; nasal branch of premaxillary extending to about middle of nasal and usually not in contact with frontal; posterior extremity of maxillary extending slightly behind that of nasal; anteorbital

foramen over posterior root of pm^3 or over space between pm^3 and pm^4. Palate relatively narrower than in the European

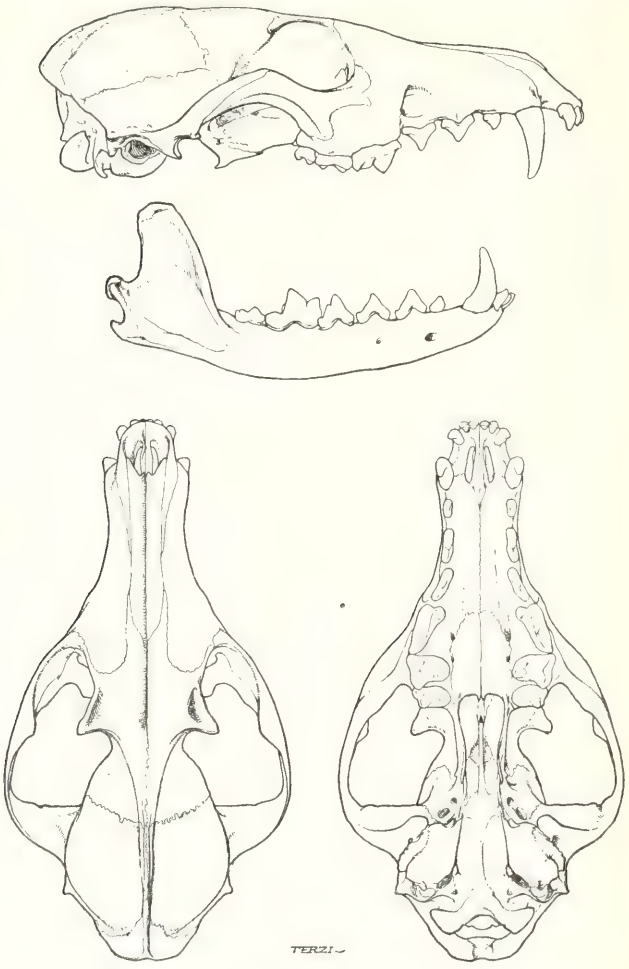

FIG. 66.
Vulpes vulpes. × ½.

species of *Alopex* and *Canis*, its median posterior termination about at level of middle of last molar; mesopterygoid fossa

about twice as long as wide, the sides gradually converging posteriorly; hamulars slender, straight; incisive foramina about four times as long as wide, the median septum usually wider than the foramen, the posterior margin a little in front of posterior margin of alveolus of canine. Mandible slender, but with no special peculiarities of form.

Teeth.—In general form and structure the teeth do not differ very widely from those of *Canis lupus*. The canines are, however, relatively much longer and more slender (fig. 65), the incisors are weaker and narrower, and the premolars show a more decided tendency to develop secondary cusps. Upper incisors slender, not closely crowded, their crowns relatively narrower than in either *Canis lupus* or *Alopex lagopus*, the secondary cusps obsolete, early disappearing with wear, the cingulum barely indicated; lower incisors with crowns less simplified than in the upper teeth, the usual longitudinal groove present on posterior surface, and i_3 with well developed outer basal lobe. Upper canine slender, its diameter at alveolus about 7 mm., its height when unworn usually about three times as great; lower canine with diameter contained about $2\frac{1}{2}$ times in height. Premolars with no special peculiarities, their crowns relatively narrower than in *Canis lupus*, and secondary cusps tending to be more developed, the latter character varying in different geographical forms. Upper carnassial with inner lobe better developed than in *Canis*, and bearing a distinct terete cusp, its position a little more forward and outward than in the dogs, so that it appears to lie in or nearly in the main axis of the tooth. Lower carnassial with posterior heel essentially as broad as main portion of tooth, the cusps essentially as in *Canis*, but general aspect of tooth more trenchant. Upper molars differing from those of *Canis* in the relatively smaller size of paracone and metacone, these cusps appearing to stand in from border of crown, leaving a noticeable cingulum beyond them; paraconule obsolete. Second and third lower molars with no marked peculiarities.

FIG. 67.
Vulpes vulpes. Teeth. Nat. size.

Remarks.—With the material at hand it has been impossible to reach wholly satisfactory conclusions with regard to the number of local forms represented by the common foxes of various parts of Europe. The existence of three such races, one in the Scandinavian Peninsula, a second in Central Europe, and a third in the Iberian Peninsula, seems well established; but the status of the forms inhabiting Italy and Greece is still in doubt.

Vulpes vulpes vulpes Linnæus.

1758. [*Canis*] *vulpes* Linnæus, Syst. Nat., I, 10th ed., p. 40 (Sweden).
1758. [*Canis*] *alopex* Linnæus, Syst. Nat., I, 10th ed., p. 40 (Sweden).
1798. *C*[*anis*] *vulpus* Thunberg, Beskrifning på Svenske Djur, Mamm., p. 7 (Variant of *vulpes*).
1816. *V*[*ulpes*] *vulgaris* Oken, Lehrb. d. Naturgesch., III, pt. 2, p. 1034 (Renaming of *vulpes*).
1820. *Canis nigro-argenteus* Nilsson, Skand. Fauna, I, p. 91 (Lofoten Islands, Norway).
1827. [*Canis vulpus*] γ *nigrocaudatus* Billberg, Synopsis Faunæ Scandinaviæ, p. 12 (Uppland, Sweden).
1827. [*Canis vulpus*] ζ *variegatus* Billberg, Synopsis Faunæ Scandinaviæ, p. 13 (Uppland, Sweden).
1827. [*Canis vulpus*] η *lineatus* Billberg, Synopsis Faunæ Scandinaviæ, p. 13 (Skåne, Sweden).
1830. ? [*Vulpes*] *communis* Burnett, Quart. Journ. Sci. Lit. Art, XXVIII, 1829, p. 349 (Substitute for *vulpes*). Nomen nudum.
1898. *Vulpes vulpes* Thomas, The Zoologist, 4th ser., II, p. 100, March, 1898 (part).
1910. *Vulpes vulpes* Trouessart, Faune Mamm. d'Europe, p. 93 (part).

Type locality.—Upsala, Sweden.

Geographical distribution.—Scandinavian Peninsula.

Diagnosis.—Teeth larger and more robust than in the central and southern races, the premolars tending to be slightly spaced or in contact; skull attaining maximum size for European foxes.

Measurements.—For cranial and dental measurements see Tables, pp. 334, 335.

Specimens examined.—Seven skulls from Sweden (for exact localities see Table of cranial measurements), and eleven from Egersund, Stavanger, Norway.

Remarks.—While I have seen no skins of this fox, the distinctness of the race from those occurring in central and southern Europe seems well established by the characters of the teeth.

skull.	Sweden.	Wheelwright (c).	64. 3. 8. 2.
11 skulls.	Egersund, Stavanger, Norway.	K. H. Schaanning (c).	11. 6. 3. 1–11.

Vulpes vulpes crucigera Bechstein.

1789. [*Canis*] *crucigera* Bechstein, Gemeinn. Naturgesch. Deutschlands, I, p. 250 (Thüringen, Germany).
1792. *C*[*anis*] *Vulpes alopex europaeus* Kerr, Anim. Kingd., p. 142 (Burgundy, France).
1797. *Canis vulpes alba* Borkhausen, Deutsche Fauna, I, p. 33 (Vogelsberg, near Rudigshain, Hessen, Germany).
1797. *Canis vulpes nigra* Borkhausen, Deutsche Fauna, I, p. 33 (Hessen and Thüringen, Germany).
1801. *C*[*anis*] *v*[*ulpes*] *lutea* Bechstein, Gemeinn. Naturgesch. Deutschlands, I, 2nd ed., p. 628 (Thüringen, Germany).
1801. *C*[*anis*] *v*[*ulpes*] *cinerea* Bechstein, Gemeinn. Naturgesch. Deutschlands, I, 2nd ed., p. 628 (Thüringen, Germany).
1832. *Canis melanogaster* Bonaparte, Iconogr. Fauna Ital., I, fasc. 1 (Neighbourhood of Rome, Italy).
1841. *Vulpes hypomelas* Wagner, Schreber's Säugthiere, Suppl., II, p. 405 (Oberbayern, Germany).
1857. *Canis vulpes* Blasius, Säugethiere Deutschlands, p. 191.
1861. ? *V*[*ulpes*] *vulgaris meridionalis* Fitzinger, Wissensch.-pop. Naturgesch. der Säugeth., I, p. 194 (Dalmatia).
1910. *Vulpes vulpes* (part) and *V. vulpes melanogaster* Trouessart, Faune Mamm. d'Europe, pp. 93–94.

Type locality.—Thüringen, Germany.

Geographical distribution.—Central and southern Europe from Ireland eastward and from the coast of the Baltic to the Pyrenees, Italy and Greece.

Diagnosis.—Maximum size rather less than in *V. v. vulpes*, and teeth distinctly smaller, the premolars rather widely spaced and seldom if ever in contact; general colour a bright yellowish or reddish brown, the posterior half of back not conspicuously frosted with whitish, and tail never clear greyish.

Colour.—In seventeen skins the general colour ranges from nearly cinnamon-rufous to a light ochraceous-rufous, the sides of neck and region immediately behind shoulder lighter than median dorsal area (in extreme instances clear buff with a decided rufous tinge); posterior half of back with evident white frosting in some specimens, scarcely any in others, but this character never so pronounced as in average Spanish skins; underparts dull slaty overlaid with white, the slaty nearly always predominating, except on throat, and not infrequently giving the effect of an almost blackish tinge throughout, this apparently not in the least dependent on regional or local climatic conditions. In a flat skin from Cephalonia, Greece, the characteristic slaty and white is confined to the throat and chin, all the rest of the ventral region being a dull tawny-ochraceous like sides. Two specimens from Tatoi, near Athens, taken in July, have shed all the longer hairs of the back, leaving only the velvety underfur. This is of the usual colour, a dull umber brown, in one specimen with a slaty cast.

Skull and teeth.—The skull and teeth do not attain so great

size as in true *Vulpes vulpes*, and the small premolars are seldom in contact, the spaces between them usually conspicuous.

Measurements.—Adult female from Cappagh House, Waterford, Ireland: head and body, 613; tail, 340; hind foot, 146; ear from meatus, 90. Adult male and female from Tunbridge Wells, Sussex, England: head and body, 690 and 630; tail, 343 and 370; hind foot, 160 and 141; ear from meatus, 95 and 82. Adult male from Ingelheim, Rheinhessen, Germany: head and body, 578; tail, 440; hind foot, 160; ear from meatus, 98. Adult male and female from Haute-Garonne, France: head and body, 610 and 610; tail, 370 and 350; hind foot, 150 and 135; ear from meatus, 94 and 89. Two adult males from Porlezza, Como, Italy (Ghidini): hind foot, 150 and 148·6. Adult male from Borghetto S. Spirito, Italy: head and body, 745; tail, 380; hind foot, 157. Adult male from Zinnigas, Siliqua, Sardinia (measured from mounted specimen, Genoa): head and body, 700; tail, 300; hind foot, 144±; ear from meatus, 83.

Specimens examined.—Fifty, from the following localities:—
Ireland: Kilmanock, Wexford, 2; Cappagh House, Waterford, 1.
Scotland: Ben Nie, Sutherland, 1; Inversanda, Ardgour, 1.
England: Northumberland, 1; Thame, Oxford, 2; Hassocks, Sussex, 1; Tunbridge Wells, Sussex, 3; Ditchling, Sussex, 1; Mayfield, Sussex, 1 (Grant).
France: Ax-les-Thermes, Ariège, 3; Caterille, Haute-Garonne, 1; Pic Sessire, Haute-Garonne, 1; St. Aventin, Haute-Garonne, 1.
Germany: Ingelheim, Rheinhessen, 1; Nuremberg, Bavaria, 1 (U.S.N.M.); Grossgraben, Silesia, 1 (Breslau); Riesengiberge, Silesia, 1 (Breslau); southern Germany, 3.
Austria-Hungary: Trentino, 1 (Genoa); Gazza, Trentino, 1 (Genoa); Vigolo Vattaro, Trentino, 1 (Genoa).
Switzerland: Geneva, 1 (Ghidini); Valais, 1 (Ghidini).
Italy: Porlezza, Como, 4 (Ghidini); Garbagna, Piedmont, 1 (Genoa); Borghetto S. Spirito, 1 (Genoa); Vargo, Liguria, 1 (Genoa); Torriglia, Liguria, 1 (Genoa); Cornigliano, Liguria, 2 (Genoa); near Genoa, 1; Molasana, 1 (Genoa); Tuscany, 1; Pisa, 1.
Sardinia: Zinnigas, Siliqua, 1 (Genoa).
Greece: Cephalonia, 1; Tatoi, near Athens, 2.

Remarks.—The fox of Italy appears to be the same as that of Central Europe, though further material from the southern portion of the peninsula may show that it should be distinguished. The three specimens from Greece are in such unsatisfactory condition of pelage that their status cannot be determined with any degree of certainty. If they represent a peculiar local race this should probably take the name *meridionalis* Fitzinger.

♀.	Ben Nie, Sutherlandshire, Scotland. (*H. Brown.*)	E. R. Alston (P).	79. 9. 25. 80.
♂.	Inversanda, Ardgour.	H. Leigh (C & P).	1. 16. 12. 1.
2.	Kilmanock, Wexford, Ireland.	G. Barrett-Hamilton (C & P).	6. 5. 20. 1. 9. 12. 15. 4.
♀.	Cappagh House, Waterford.	R. J. Ussher (C & P).	96. 12. 28. 1.
1.	Northumberland, England.	Rev. H. H. Slater (C & P).	0. 2. 24. 5.

2 ♂.	Thame, Oxfordshire.	Hon. N. C. Rothschild (P).	0. 10. 31. 1–2.
2 ♂.	Ditchling, Sussex.	Guy Dollman (C & P).	9. 11. 3. 1. 10. 9. 13. 1.
3.	Tunbridge Wells, Sussex.	C. H. B. Grant (C).	1. 2. 15. 1–3.
2 ♂, ♀.	Ax-les-Thermes, Ariège, France.	V. Builles (C & P).	8. 3. 27. 6–7. 8. 3. 27. 14.
♀.	Caterille, Haute-Garonne, 900 m. (*A. Robert.*)	O. Thomas (P).	8. 7. 15. 2.
♀.	Pic Sessire, Haute-Garonne. (*A. Robert.*)	O. Thomas (P).	8. 7. 15. 3.
♂.	St. Aventin, Haute-Garonne, 900 m. (*A. Robert.*)	O. Thomas (P).	8. 7. 15. 4.
♂.	Ingelheim, Rheinhessen, Germany.	C. Hilgert (C).	8. 11. 2. 15.
3 skulls.	South Germany.	Dr. A. Günther (C).	59. 9. 6. 83, 88. 175. k.
♂.	Genoa, Liguria, Italy.	Marquis G. Doria (P).	88. 12. 1. 3.
skull.	Pisa.	Zool. Soc. Mus.	58. 5. 4. 126.
1 yg.	S. Italy. (*Prof. Savi.*)	Zool. Soc. Mus.	55. 12. 24. 240.
♀.	Tuscany.	Purchased (Dr. Rüppell).	45. 7. 22. 15.
♂, ♀.	Tatoi, Athens, Greece. (*C. Mottaz.*)	Hon. N. C. Rothschild (P).	8. 10. 2. 22–23.

Vulpes vulpes silacea Miller.

1907. *Vulpes vulpes silaceus* Miller, Ann. and Mag. Nat. Hist., 7th ser., xx, p. 393, November, 1907. Type in British Museum.
1910. *Vulpes vulpes silaceus* Trouessart, Faune Mamm. d'Europe, p. 45.

Type locality.—Near Silos, Province of Burgos, Spain.

Geographical distribution.—Iberian Peninsula.

Characters.—Size about equal to that of *V. r. vulpes*, but teeth noticeably less enlarged, the wider spacing of the premolars especially evident; general colour a dull buff without bright yellowish or reddish tints, the posterior half of back conspicuously frosted with whitish (except in abraded pelage) the tail often a clear greyish.

Measurements.—Type (adult male): head and body, 750; tail, 370; hind foot, 150. Adult female from near the type locality: head and body, 670; tail, 330; hind foot, 125. Old male from Elche, Alicante: head and body, 770; tail, 480; hind foot, 160; ear from meatus, 113.

Specimens examined.—Eighteen, from the following localities in Spain: Olot, Gerona, 1 (probably not typical); vicinity of Silos, Burgos, 5; near Burgos, 1; Arrechavaleta, Vitoria, 1; Torres del Allo, Coruña, 1; Madrid, 1; near Seville, 3; Coto Doñana, Huelva, 3 (B.M. and U.S.N.M.); Elche, Alicante, 1; Barracas, Castellon, 1.

Remarks.—The Spanish fox is well characterized by its light colour, large size and rather small, widely-spaced premolars as compared with those of the Scandinavian form.

2 ♂.	Silos, Burgos, Spain.	G. S. Miller (C).	8. 8. 4. 46–47. (8. 8. 4. 46. *Type* of subspecies.)
♂, 2 ♀, 1.	Burgos.	Rev. Saturio Gonzalez (C).	8. 7. 7. 12–15.

CRANIAL MEASUREMENTS OF *VULPES VULPES*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Mastoid breadth.	Interorbital breadth.	Rostral breadth over canines.	Depth of brain-case excluding crest.	Palatal depth behind tooth-row.	Rostral depth behind canine.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
V. vulpes vulpes.														
Sweden: no exact locality .	64. 3. 8. 2	♂?	136·0	73·0	46·0	23·0	23·4	39·4	36·0	17·0	103·0	61·4	69·6	Teeth moderately worn.
Lycksele Lappmark .	Stockholm	♂?	155·0	83·8	48·0	30·2	28·8	42·6	36·8	19·8	121·6	74·0	84·8	,, slightly worn.
Skabersjö . . .	,,	♂	152·2	83·0	50·0	30·6	29·0	41·8	37·8	24·2	119·4	68·4	77·6	,, ,,
Framäs, Södermanland	,,	♀	136·2	75·8	47·0	28·2	26·0	40·0	35·2	18·4	102·6	61·2	70·0	,, not worn.
Hamra Gård, Tumba .	,,	♀?	136·6	77·6	46·8	29·2	25·2	40·0	34·6	18·0	104·6	62·6	71·0	,, slightly worn.
Skåne . . .	,,	♂?	143·2	75·4	48·0	26·4	24·4	39·6	36·6	18·0	113·6	68·0	74·6	,, not worn.
,, . . .	,,	♂?	145·8	81·4	47·8	27·6	26·8	43·2	36·4	18·4	111·8	66·8	74·4	,, slightly worn.
Norway: Stavanger . .	11. 6. 3. 1	♂?	145·0	79·6	49·2	29·6	26·8	41·2	38·0	18·2	118·4	69·2	82·0	,, not worn.
,, . . .	11. 6. 3. 3	♂?	149·2	75·8	49·0	29·0	24·4	41·4	37·6	19·8	116·4	70·4	78·0	,, ,,
,, . . .	11. 6. 3. 11	♂?	150·4	78·2	—	29·2	24·8	41·8	36·0	18·4	115·8	69·4	75·2	,, ,,
,, . . .	11. 6. 3. 10	♀?	135·4	79·6	47·4	27·4	25·6	42·0	35·0	19·0	104·6	64·2	71·4	,, slightly worn.
V. vulpes crucigera.														
Scotland: Ben Nie, Sutherlandshire . .	79. 9. 25. 80	♀	141·4	77·4	48·0	—	24·0	40·4	35·0	19·8	110·4	63·0	73·0	,, much worn.
Inversanda, Ardgour .	1. 6. 12. 1	♂	154·0	86·8	53·0	32·6	28·0	40·4	40·0	23·0	119·0	68·8	78·0	,, slightly worn.
England: Northumberland .	0. 2. 24. 5	♀?	—	73·0	47·0	—	23·0	38·0	35·0	16·4	105·4	62·6	71·0	,, not worn.
Tunbridge Wells, Sussex . .	1. 2. 15. 3	♀	136·0	73·2	45·4	27·8	24·2	39·0	35·0	17·0	104·0	61·0	69·6	,, moderately worn.
,, ,,	1. 2. 15. 1	♂	148·0	84·0	50·0	31·2	27·0	40·4	37·0	18·8	114·0	65·8	73·4	,, slightly worn.
Mayfield . .	Grant 171	♂	149·6	80·4	51·2	29·4	26·2	40·0	37·2	20·2	116·2	65·8	75·8	,, not worn.
France: Ax-les-Thermes, Ariège	T.V.S. 557		141·8	75·4	48·0	29·0	25·0	41·8	36·0	16·8	110·6	65·0	74·2	,, ,,
,, ,,	,, 558	♂	139·6	78·2	48·8	29·0	23·6	40·2	36·0	18·4	107·6	62·6	71·0	,, slightly worn.
,, ,,	,, 563		142·0	79·8	47·2	29·8	25·2	41·0	34·2	17·4	110·0	65·4	73·8	,, ,,
St. Aventin, Haute-Garonne . .	8. 7. 15. 4	♂	138·6	75·0	47·8	27·2	24·8	38·4	34·0	19·0	107·0	61·4	69 2	,, not worn.

France: Caterille, Haute-Garonne	8. 7. 15. 2	♀	131·6	71·2	45·0	28·2	22·0	38·4	33·0	17·2	100·0	58·4	65·6	Teeth moderately worn
,, ,,	8. 7. 15. 3	♀	126·0	75·4	43·0	29·2	22·2	38·0	34·0	16·8	97·6	59·0	65·0	,, ,,
Germany: Southern Germany	175k	♂	138·0	77·4	46·4	—	23·6	40·0	36·0	17·6	107·8	64·6	71·8	,, not worn.
,, ,,	59. 9. 6. 83	♂	140·4	76·2	47·4	—	22·8	41·2	38·0	17·8	111·4	63·4	72·2	,, ,,
,, ,,	59. 9. 6. 88	♂?	142·0	76·0	47·6	—	25·0	38·8	34·0	17·4	107·8	64·0	71·4	,, ?
Ingelheim, Rheinhessen	8. 11. 2. 15	♂	138·6	74·8	47·4	29·8	24·2	42·2	35·0	18·2	105·4	61·4	70·0	,, not worn.
Nuremberg, Bavaria	869 (U.S.N.M.)		136·0	76·8	46·6	29·6	25·0	40·4	35·0	18·6	104·4	63·6	68·0	,, slightly worn.
Grossgraben, Silesia.	Breslau	♂	139·6	80·2	50·2	29·2	23·2	43·2	35·4	18·2	107·4	64·0	72·6	,, not worn.
Riesengebirge ,,	,,	♀?	133·4	79·0	47·6	28·4	24·8	39·6	35·8	18·0	104·6	61·8	66·2	,, ,,
Italy: Tuscany	45. 7. 22. 15	♀	134·0	76·0	46·4	26·8	23·0	40·0	34·0	16·0	103·6	61·0	67·6	,, ?
near Genoa	88. 12. 1. 3	♂	136·0	78·6	48·0	28·0	23·0	40·0	35·0	17·0	106·0	60·0	69·0	,, not worn.
,,	Genoa 140	♂	144·6	80·4	49·0	—	25·0	38·6	35·0	20·0	113·0	68·0	73·0	,, slightly worn.
Borghetto S. Spirito	,,	♂	145·0	81·0	49·0	—	25·0	40·0	36·0	20·0	112·0	68·0	76·0	,, ,,
Sardinia: Zinnigas, Siliqua	,,	♂	144·0	80·0	47·0	—	25·0	40·0	35·6	18·0	114·0	65·0	72·0	,, ,,
Greece: Tatoi, near Athens	8. 10. 2. 22	♂	137·6	82·0	47·4	29·2	24·8	41·0	36·4	18·8	107·2	63·2	73·2	,, ,,
,, ,,	8. 10. 2. 23	♀	133·2	73·6	45·2	24·2	21·2	38·2	31·8	16·2	102·2	58·2	66·4	,, ,,
V. vulpes silacea.														
Spain: Olot, Gerona.	—	♂	139·4	80·6	47·4	29·6	23·6	40·4	35·6	18·0	110·4	64·2	73·6	,, ,,
Coruña	94. 5. 29. 1	—	—	80·0	—	30·0	25·8	—	37·0	21·0	113·0	66·6	74·0	,, ,,
near Silos, Burgos.	8. 8. 4. 46*	♂	143·0	87·0	48·8	29·0	24·0	41·0	35·4	17·6	99·6	65·0	73·0	,, not worn.
,, ,,	8. 7. 7. 13	♀	127·0	72·0	45·2	25·2	21·8	39·4	33·4	16·0	99·0	58·0	65·0	,, ,,
,, ,,	172130	♂?	138·0	—	48·0	27·2	23·0	37·0	35·0	19·0	107·0	63·0	71·0	,, slightly worn.
,, Madrid	8. 9. 24. 7	♂	154·6	86·0	52·6	27·8	27·0	40·4	39·0	20·0	120·4	68·6	76·6	,, moderately worn.
,, Seville	95. 9. 4. 7	♂	151·0	84·0	50·0	30·4	24·6	39·4	38·0	18·4	117·0	71·0	79·0	,, slightly worn.
,, ,,	95. 9. 4. 8	♂	145·0	82±	47·6	27·6	24·2	39·0	37·0	19·0	113·0	67·0	74·4	,, moderately worn.
,, ,,	95. 9. 4. 9	♀	132·0	76·0	45·0	25·2	22·8	38·4	33·4	17·0	102·0	61·4	69·6	,, slightly worn.
Coto Doñana, Huelva	8. 3. 8. 4	♂	137±	77·0	—	27·2	23·2	—	39·0	18·0	108·0	66·0	72·8	,, not worn.
,, ,,	8. 3. 8. 5	♂	153±	88·6	53·0	31·6	25·0	—	36·8	21·2	126·0	71·4	82·0	,, moderately worn.
Elche, Alicante	8. 8. 4. 48	♂	155·4	92·0	51·4	33·0	27±	41·4	38·6	21·0	123·0	71·0	80·0	,, much worn.

* Type.

♀.	Arrechavaleta, Vitoria. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 49.
♂.	Torres del Allo, Coruña.	Dr. V. L. Seoane (C & P).	94. 5. 29. 1.
♂.	Madrid.	M. de la Escalera (C).	8. 9. 24. 7.
♂, ♀.	Seville. (*A. Ruiz.*)	Lord Lilford (P).	95. 9. 4. 7–8.
2 ♂.	Coto Doñana, Huelva.	A. Chapman (C & P).	8. 3. 8. 4–5.
♂.	Elche, Alicante.	G. S. Miller (C).	8. 8. 4. 48.
♂ juv.	Barracas, Castellon. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 50.

VULPES ICHNUSÆ Miller.

1907. *Vulpes ichnusæ* Miller, Ann. and Mag. Nat. Hist., 7th ser., xx, p. 391, November, 1907. Type in British Museum.
1910. *Vulpes vulpes ichnusæ* Trouessart, Faune Mamm. d'Europe, p. 94.

Type locality.—Sarrabus, Sardinia.

Geographical distribution.—Sardinia and Corsica.

Diagnosis.—Smaller than any of the races of *Vulpes vulpes*; both hind foot and condylobasal length of skull in adult male less than 130 mm., ear from crown 60 to 70 mm.

Colour.—Face and head dark rufous becoming lighter and more dull on base of ears and on neck, and fading to ochraceous-rufous on shoulders and back: sides of neck, outer surface of upper arm and region just behind axilla still lighter, a tawny buff, hairs of underfur on back drab grey at base, tawny clay colour at tip; longer hairs of head, sides, and back (behind shoulders) much speckled by buffy white subterminal areas about 5 mm. in length, the extreme tips reddish: feet and legs ochraceous-rufous, slightly clouded with blackish and a little speckled with buffy white: tail like back above, the tawny gradually fading out through a buffy grey to the whitish buff tip, the longer hairs except in pencil black tipped (30–40 mm.); underparts to front legs buffy whitish tinged with hair-brown, this nearly clear on middle of throat; rest of underparts a mixture of hair-brown and dull tawny, the latter predominating along sides.

Measurements.—Type (adult male): hind foot, 123: ear from meatus, 70. Adult male and female from the type locality: head and body, 640 and 590: tail, 280 and 290: hind foot, 127 and 125: ear from meatus, 74 and 71. Adult female from Siliqua: head and body, 600: tail, 350: hind foot, 127: ear, 74. Adult from near St. Florent, Corsica: hind foot, 123: ear from meatus, 73.

Specimens examined.—Eight, from the following localities:—

Corsica: Grotto Campu Consule, near St. Florent, N.W. Corsica, 1 (Major).

Sardinia: No exact locality, 1 (Turin); Lanusei, 1; Sarrabus, 3 (B.M. and Genoa); Zinnigas Siliqua, 2.

CRANIAL MEASUREMENTS OF *VULPES ICHNUSÆ*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Mastoid breadth.	Interorbital breadth.	Rostral breadth over canine.	Depth of braincase (excluding crest).	Palatal depth behind tooth-rows.	Rostral breadth behind canine.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
V. ichnusæ.														
Sardinia: Sarrabus .	88. 12. 1. 2*	♂	129·0	78·0	47·0	25·2	22·0	41·0	33·0	17·0	100·4	59·0	65·4	Teeth moderately worn.
Lanusei .	0. 2. 21. 1	♂	128·0	72·0	45·6	—	22·0	39·0	32·0	14·0	99·4	55·0	64·0	,, slightly worn.
Sarrabus .	Gonoa	♂	123·0	69·2	44·0	—	21·0	38·0	33·4	16·8	97·0	55·0	63·0	,, much worn.
Corsica: near St. Florent	Major		131·6	75·8	45·2	25·6	23·2	37·2	32·4	17·6	103·2	58·8	66·0	,, slightly worn.

* Type.

DENTAL MEASUREMENTS OF *VULPES VULPES* AND *V. ICHNUSÆ*.

Locality.	Number.	Sex.	Upper carnassial.	First upper molar.	Lower carnassial.	Observations.
V. vulpes vulpes.						
Sweden: Lycksele, Lappmark.	Stockholm	♂?	17·0 × 8·8	11·2 × 12·8	17·8 × 6·4	Teeth slightly worn.
Skabersjö.	,,	♂	16·4 × 7·6	10·8 × 12·2	17·0 × 6·2	,, ,,
Framäs	,,	♀	15·0 × 7·2	9·8 × 11·0	14·6 × 6·0	,, not worn.
Hamra Gård, Tumba	,,	♀?	15·8 × 7·6	10·0 × 11·8	14·8 × 6·0	,, slightly worn.
Skåne	,,	♂?	15·6 × 7·8	9·8 × 12·0	16·8 × 6·2	,, not worn.
,,	,,	♂?	16·8 × 8·0	10·6 × 12·2	15·2 × 6·2	,, slightly worn.
Norway: Stavanger	11. 6. 3. 1.	♂?	15·0 × 7·6	10·6 × 15·0	17·4 × 6·0	,, not worn.
,,	11. 6. 3. 3.	♂?	16·2 × 8·0	10·4 × 14·2	14·2 × 6·0	,, ,,
,,	11. 6. 3. 11.	♂?	14·2 × 7·8	10·2 × 14·0	16·2 × 6·0	,, ,,
,,	11. 6. 3. 10.	♀?	14·6 × 8·0	10·0 × 13·2	16·0 × 5·8	,, slightly worn.
V. vulpes crucigera.						
Scotland: Inversanda, Ardgour	1. 6. 12. 1	♂	16·0 × 8·4	10·2 × 11·8	16·0 × 6·0	,, ,,
England: Tunbridge Wells, Sussex	1. 2. 15. 1	♂	14·8 × 6·8	9·0 × 11·0	14·4 × 5·0	,, ,,
,, ,,	1. 2. 15. 3	♀	15·0 × 6·8	9·4 × 11·0	15·0 × 5·2	,, moderately worn.
France: Ax-les-Thermes, Ariège	8. 3. 27. 7		14·8 × 6·6	9·2 × 11·2	15·6 × 5·8	,, not worn.
,, ,,	8. 3. 27. 14	♂	16·2 × 7·8	10·0 × 11·6	15·8 × 5·6	,, slightly worn.
,, ,,	8. 3. 27. 6		14·2 × 7·2	9·8 × 11·4	15·4 × 5·8	,, ,,
Caterille, Haute-Garonne	8. 7. 15. 2	♀	13·0 × 5·4	8·8 × 10·0	13·4 × 4·8	,, moderately worn.
,, ,,	8. 7. 15. 3	♀	13·8 × 6·0	9·2 × 10·2	14·2 × 5·0	,, ,,
St. Aventin, Haute-Garonne	8. 7. 15. 4	♂	14·4 × 6·2	9·4 × 11·8	15·0 × 5·0	,, not worn.

Germany: Southern Germany	175 K	♂	15·2 × 6·8	9·8 × 10·2	15·6 × 5·6	Teeth not worn.
,,	59. 9. 6. 83	♂	15·0 × 7·0	9·6 × 11·2	15·4 × 5·8	,, ?
,,	59. 9. 6. 85		15·4 × 7·4	9·6 × 12·0	15·4 × 5·8	,, ?
Ingelheim, Rheinhessen	8. 11. 2. 15	♂	14·4 × 7·0	10·0 × 10·2	15·0 × 5·8	,, not worn.
Nuremberg, Bavaria	869		14·4 × 7·0	9·8 × 11·0	15·6 × 5·6	,, slightly worn.
Italy: near Genoa	88. 12. 1. 3	♂	14·2 × 6·8	9·2 × 10·2	15·2 × 5·2	,, not worn.
Pisa	58. 5. 4. 126		13·2 × 6·6	9·6 × 9·6	13·6 × 5·2	,, ?
Tuscany	45. 7. 22. 15	♀	14·8 × 6·4	10·0 × 10·8	14·8 × 5·0	,, ?
Greece: Tatoi, near Athens	8. 10. 2. 22	♂	16·2 × 6·8	10·8 × 12·2	16·8 × 5·8	,, slightly worn.
,, ,,	8. 10. 2. 23	♀	14·2 × 6·4	9·8 × 11·0	14·8 × 4·8	,, ,,
V. vulpes silacea.						
Spain: Olot, Gerona	—	♂	15·8 × 7·6	10·0 × 11·6	16·0 × 5·4	,, ,,
Galicia	94. 5. 29. 1		15·4 × 7·4	10·2 × 11·2	16·4 × 5·0	,, ,,
near Silos, Burgos	8. 8. 7. 13	♀	14·6 × 6·2	9·0 × 11·2	13·6 × 5·0	,, not worn.
,, ,,	8. 8. 7. 16	♀	14·0 × 6·8	9·2 × 10·6	14·8 × 5·6	,, ,,
,, ,,	172130	♂?	15·2 × 6·0	9·8 × 13·2	—	,, slightly worn.
near Madrid		♂	14·8 × 6·8	10·0 × 11·4	15·2 × 5·8	,, moderately worn.
near Seville	95. 9. 4. 7	♂	16·4 × 7·2	11·0 × 12·0	16·8 × 6·0	,, slightly worn.
,,	95. 9. 4. 8	♀	15·0 × 7·2	9·8 × 11·2	15·6 × 5·8	,, moderately worn.
,,	95. 9. 4. 9	♀	14·0 × 7·0	10·0 × 11·2	15·0 × 5·2	,, slightly worn.
Coto Doñana, Huelva	8. 3. 8. 4	♂	15·4 × 8·0	10·0 × 11·6	16·0 × 5·6	,, not worn.
,, ,,	8. 3. 8. 5	♂	15·8 × 7·2	11·0 × 12·6	16·2 × 5·8	,, moderately worn.
V. ichnusæ.						
Sardinia: Sarrabus	88. 12. 1. 2*	♂	14·2 × 7·2	9·4 × 11.4	14·0 × 5·4	,, ,,
Lanusei	0. 2. 21. 1	♂	13·8 × 6·6	9·2 × 10·8	14·2 × 5·0	,, slightly worn.
Corsica: near St. Florent	Major		13·8 × 7·0	9·2 × 11·0	14·4 × 5·2	,, ,,

* Type.

[illegible]

[illegible]

Premolars $\frac{4}{4}$.
Lower carnassial without metaconid; skull robust; no European species ever derived more than 30 mm. in condylobasal length; form robust; tail short (Wolverines, sub-family *Gulinae*) ... Gulo, p. 402.
Lower carnassial with evident though small metaconid; skull slender in European species rarely if ever more than 300 mm. in condylobasal length; form slender; tail long (Martens, sub-family *Martinae*) ... Martes, p. 366.

Premolars $\frac{3}{3}$.
Lower carnassial with evident though small metaconid; basicranial region in contact with bulla; back and sides spotted and striped (Paradoxure sub-family *Paradoxurinae*) ... Nandinia, p. 345.
Lower carnassial without metaconid; tip of tooth not widely separated from trigon; back and sides rarely spotted, rarely in contact; Asiatic species with median dorsal stripe (Weasels, Polecats, &c., sub-family *Mustelinae*) ... Mustela, p. 381.

Sub-Family MELINAE

1837. *Melinæ* Baird, Mamm. North Amer., p. 146.

Geographical distribution.—Temperate and tropical portions of both hemispheres; in Europe west to Ireland and north to central Scandinavia.

Characters.—Upper carnassial with evident crushing surface, its crown triangular or rhomboid in outline; upper molar large, the length of its outer portion usually equal to or greater than that of carnassial; skull rather high and long, the rostrum longer than broad; external form short and heavy, the fur long and loose; toes not webbed, the claws large. Intestinal; tail variable in length (short in European members of the group), never unusually muscular.

Remarks.—About a dozen genera, or nearly one-half of the family, are now placed in the sub-family *Melinæ*. Only one occurs in Europe.

Genus **MELES** Brisson

1762. *Meles* Brisson, Regn. Anim. in Classes IX, distrib., 2nd ed., p. 17 (*Ursus Meles* Brisson = *Ursus meles* Linnæus).
1780. *Meles* Storr, Prodr. Meth. Mamm., p. 26. First use of name by an author following the Linnean system (*Ursus meles*).
1788. Plates Gmelin, and Forster, Magazin Encyclopédique, 1re p. 100 (*Ursus meles* Linnæus).
1818. *Melogonus* Rafinesque, Analyse de la Nature, p. 50 (Modification of *Meles*).
1827. *Meles* Fleming, Säugethiere Deutschlands, p. 102.

Type species.—*Meles* * Brisson = *Ursus meles* Linnæus.

* Not "*Meles meles*," the term by which this and many Linnæan specific names are often cited, apparently with the intention of pointing out the assembly of synonymy in connection with the name applied to genera by an author who did not follow the Linnæan system.

Geographical distribution.—Northern temperate portions of Old World; in Europe from central Scandinavia to the Mediterranean, and from Ireland eastward.

Characters.—Skull narrow and high (depth of brain-case much more than half mastoid breadth), the zygomatic arches not widely expanded, and postorbital region not specially narrowed (distance from point of greatest narrowing to zygoma less than breadth of postorbital constriction); rostrum elongate, the distance from orbit to gnathion about three-fourths length of brain-case; auditory bulla elevated along inner margin, but elsewhere somewhat flattened, the meatal tube distinct; paroccipital process robust, standing out conspicuously behind bulla; dental formula: $i\frac{3-3}{3-3}$, $c\frac{1-1}{1-1}$, $pm\frac{4-4}{4-4}$,* $m\frac{1-1}{2-2} = 38$; teeth not specially enlarged as compared with width of rostrum and palate (greatest transverse diameter of upper carnassial equal to a little more than one-third distance between carnassials); three small premolars (one upper and two lower) capable of trenchant action; upper carnassial with crown triangular in outline, the cutting portion consisting of a single large anterior cusp with its slightly developed anterior commissure and more distinct posterior commissure, the crushing portion represented by the obliquely sloping inner base of this cusp and ridge; upper molar rhombic in outline, its crown area about three times that of carnassial, its greatest diameter in axis of tooth-row, the four primitive cusps present; lower carnassial with the three anterior cusps well developed, sub-equal, the posterior heel decidedly larger than anterior triangle; external form heavy, the head pointed, the ears short but plainly visible, the body thick, the tail short, not muscular; feet subplantigrade, the toes with long fossorial claws and without webs; fur coarse and loose.

Remarks.—The genus *Meles* contains about half a dozen named forms, the status of several of which is at present not clearly understood. Two species occur in Europe.

KEY TO THE EUROPEAN FORMS OF *MELES*.

Maxillary tooth-row, exclusive of incisors, about 35 mm.; auditory bullæ rather strongly inflated, the inner border not ridge-like (Crete) *M. arcalus*, p. 352.

Maxillary tooth-row, exclusive of incisors, about 40 mm.; auditory bullæ slightly inflated, the inner border ridge-like (distribution general) *M. meles*, p. 343.

General colour moderately pale; teeth averaging smaller, less frequently attaining maximum size (Central and southern Europe) ..... *M. m. meles*, p. 348.

General colour slightly paler; teeth averaging larger, and more frequently attaining maximum size (Iberian Peninsula)..... *M. m. marianensis*, p. 352.

* In adults usually $\frac{3-3}{4-4}$, owing to the early disappearance of the small pm^1.

MELES MELES Linnæus.

(Synonymy under subspecies.)

Type locality.—Upsala, Sweden.

Geographical distribution.—Europe, west to Ireland, south to the Mediterranean and north to central Scandinavia. Eastern limits of range not known.

Diagnosis.—Size large (upper length of skull in adult more than 120 mm.; maxillary tooth-row, exclusive of incisors, about 40 mm. or more; hind foot about 90 to 110 mm.); auditory bulla moderately inflated, the highest region close to inner margin and forming an evident longitudinal ridge, the region between ridge and meatus noticeably concave; teeth large, the two lower molars together 22 mm. or more in length; postero-external border of upper molar usually convex, though occasionally straight or slightly concave.

External characters.—Pelage coarse and loose, practically without underfur, the hairs at middle of back about 60 mm. in length, those on sides longer; underparts scantily haired, the skin usually visible; palm bare, usually with a slight bristly pubescence at middle in area between tubercles; a large tubercular mass at base of digits, convex in front, concave behind, wider on outer border than on inner border, showing no tendency to trilobation; a roundish tubercle about half as large at postero-external border of palm, separated from anterior mass by a wide space; a small, ill-defined pad at base of thumb; sole densely haired from heel to a little beyond middle, then completely naked; plantar tubercles essentially like those on palm except that small pad at base of hallux is absent, and the two large masses tend to coalesce, owing to absence of the wide intervening space; surface of pads on both palms and sole finely rugose, this especially noticeable in dried specimens; muzzle pad entirely naked, but separated from upper lip by a narrow hairy band. Mammæ: a 2–2, i 1–1 = 6.

Colour.—Back and sides a coarse grizzle of black and buffy white, the black usually predominating on back, the lighter colour on sides. Throat, median ventral area and all four legs and feet black or blackish; face, chin and entire neck (except underside) clear whitish except for a broad dark brown or black band beginning on each side about 15 mm. behind nostril pad and extending back, including eye and ear, to middle of neck, where it fades insensibly into colour of back; width of white median area on face usually greater than that of the dark lateral stripe, and about equal to that of the light area between lateral stripe and dark ventral area; ear black, its anterior border white in strong contrast; eye usually a little below middle of dark band; tail like back at base, soon fading to soiled white.

Skull.—Except for the greatly developed sagittal crest, the

height of which in old individuals is equal to nearly half interorbital breadth, the skull of *Meles meles* is rather smooth and without marked angularity. Depth of brain-case (without crest) and depth through posterior portion of orbit nearly equal, and about two-thirds mastoid breadth ; depth at front of nasal about two-thirds that at orbit. Dorsal profile (without crest) nearly flat from middle of brain-case to interorbital region, convex over posterior half of brain-case ; rostrum sloping downward at angle of about 30° with surface of brain-case. When crest is fully

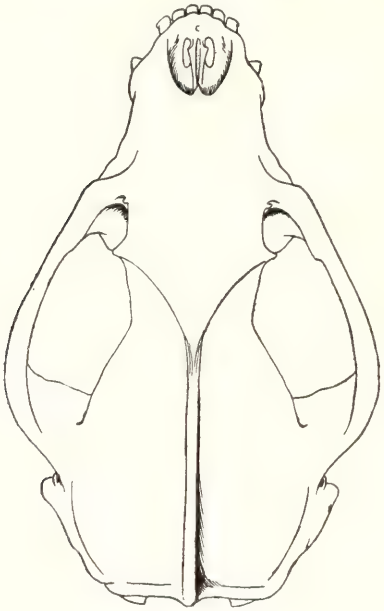

FIG. 68.
Meles meles. × ¼.

developed it reduces this angle to 20° or less. It is slightly convex anteriorly, rather abruptly convex posteriorly, the hindermost portion slightly overhanging. Postorbital processes short but well developed, sharply outlining the small orbit (greatest diameter of orbit slightly less than half that of interorbital region) which, though widely open posteriorly, is more than half encircled with bone. Rostrum moderately long, the distance from gnathion to front of zygoma about equal to width of palate including molars, and continued about 3½ times in condylobasal length of skull. Zygomata widely spreading posteriorly, narrow

anteriorly, the widest portion opposite front of glenoid fossa, the arch very slightly bowed upward. Anteorbital foramina rather large, sub-circular in outline, their greatest diameter about half that of orbit. Ventral profile of skull slightly concave throughout. Palate moderately wide, the distance between molars contained about $2\frac{1}{2}$ times in distance from gnathion to level of posterior edge of molar. Incisive foramina small, at level of space between canine and i^3, elongate pyriform in outline, the minute median foramen a little behind middle. Posterior extension of palate about equal to distance between molars, and slightly more than half that from molar to hamular. Mesopterygoid

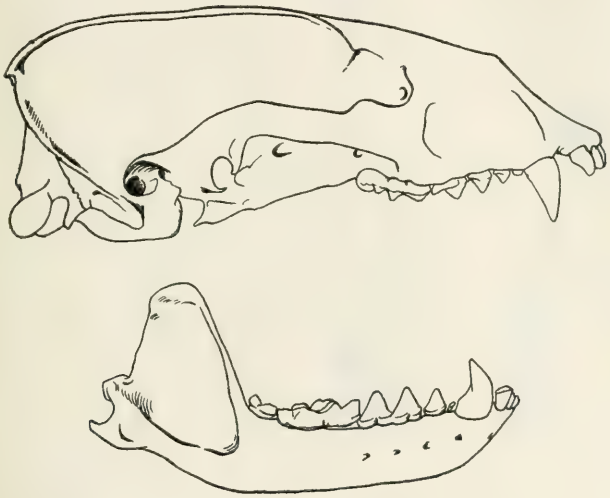

FIG. 69.
Meles meles. × ¾.

space short and wide, its length only a little more than distance between tips of hamulars. Auditory bullæ slightly inflated, irregularly triangular in outline, the meatus lying in angle formed by the large, forward-projecting mastoid process. The surface is irregular, with evident ridge near inner margin along crest of most highly inflated region, this ridge often terminating anteriorly in a bluntly pointed projection. Length of flattened portion extending inward from meatus about equal to transverse diameter of inflated portion of bulla, but the two regions not sharply defined; least distance between bullæ about $1\frac{1}{2}$ times diameter of inflated portion; paroccipital process short, triangular (not ridge-like), its extreme base applied to posterior border of bulla.

Mandible heavily built, the ramus nearly straight, the lower border with the usual upward curve posteriorly, its depth at middle about one-third that through coronoid process ; angular

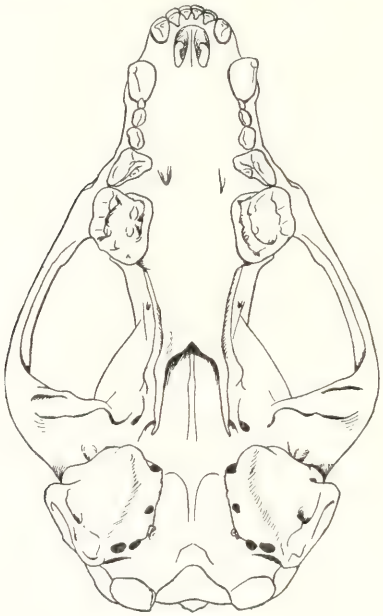

FIG. 70.
Meles meles. × ¾.

process short, thick, and ill-defined, lying close to base of articular process ; coronoid process squarely truncate above, its height above articular process about equal to width at articular level.

Teeth.—The teeth are moderately large relatively to size of skull, the incisors and canines rather short, the crown area of the upper molar fully double that of any of the other maxillary teeth, this last peculiarity unique among the European *Mustelidæ*. Upper incisors robust, the crowns somewhat higher than wide when viewed from in front, the teeth closely crowded in a slightly convex row, the longitudinal diameter of crown a little greater than transverse diameter ; i^1 and i^2 sub-equal, the latter slightly the larger, their anterior surface convex with two faint longitudinal grooves soon disappearing with wear, the cutting edge entire, the posterior surface concave with narrow but distinct heel ; i^3 with crown area about double that of i^2 and nearly half

that of canine, its crown higher than in the other incisors, owing to lower insertion of root, but extremity of cutting edge not extending beyond level of smaller teeth; laterally the cutting edge is continued down outer-posterior margin of shaft where it functions against lower canine. Lower incisors not so large as upper, forming a continuous, nearly straight row between canines, the shafts straight, sloping obliquely forward, the root of i_2 implanted behind the others; cutting edge irregularly 2-lobed, that of i_3 longer than the others. Canines rather short and weak, the shaft simple, that of upper tooth nearly straight, that of lower tooth strongly curved backward, the enamel surface of both essentially smooth, though that of lower canine shows indications of a rudimentary cingulum in front. Anterior premolar both above and below a minute or spicular tooth closely crowded between canine and second premolar, pm^1 early deciduous, pm_1 usually more persistent. Second premolars similar to each other, the crown area about equal to that of i^2, the outline irregularly oval when viewed from above, the cusp about as high as long, its apex slightly in front of middle of crown; root of each tooth single, that of pm_2 showing a tendency to become divided longitudinally. Other small premolars (pm^3, pm_3 and pm_4) alike in form, the crowns laterally compressed, triangular when viewed from the side, with apex slightly in front of middle, pm^3 and pm_3 nearly alike in size, pm_4 somewhat longer; cingulum very slightly developed, not forming secondary cusps. Upper carnassial triangular in outline, the postero-internal border longest; outer, trenchant portion of teeth consisting of a main anterior cusp resembling pm_4 in size and form, joined by a nearly horizontal commissure to a moderately high posterior cusp; cingulum low but bearing three distinct secondary cusps, one at anterior base of main cusp, one (sometimes obsolete) near middle of antero-internal border, and the third and largest at middle of postero-internal border. Lower carnassial with anterior triangle well developed, the three cusps sub-equal in height, the metaconid subterete, the protoconid more compressed than paraconid, its commissure slightly longer than that of the anterior cusp; crushing portion of crown longer and wider than anterior triangle, its inner portion occupied by a large basin-like concavity, its border with two large cusps on outer edge (of

FIG. 71.
Meles meles. Teeth. Nat. size.

which the anterior is the larger), a large cusp similar to postero-external cusp at middle of inner margin; posterior margin occupied by three or four minute cusps soon disappearing with wear, and a similar minute cusp sometimes in angle behind protoconid and metaconid. Second lower molar flat, terete, its area about half that of crushing portion of carnassial; middle of crown with basin-like concavity; margin with small but evident antero-external and postero-external cusps, and a smaller elevation at middle of inner edge. Upper molar rhomboidal in outline, the inner and outer margins parallel, the former nearly 1½ times as long as latter; outer border occupied by two rather large, subterete, conical cusps, the anterior (paracone) slightly larger than posterior (metacone), so that greatest transverse diameter of crown is slightly behind anterior border; remainder of crown a shallow basin-like concavity with rugose surface and raised, irregularly nodulate margin, the middle of concavity crossed by a ridge, convex internally, extending from anterior base of paracone to posterior base of metacone and bearing from three to five small cusps soon obscured by wear, the three anterior separated from two posterior by a deep angle; the anterior group probably representing the protocone, the posterior group the hypocone.

Remarks.—Two moderately well differentiated local races are represented by the material that I have examined, one confined to the Iberian Peninsula, the other general in distribution. British specimens do not differ appreciably from Swedish examples of the typical form.

Meles meles meles Linnæus.

1758. [*Ursus*] *meles* Linnæus, Syst. Nat., I, 10th ed., p. 48 (Sweden).

1785. [*Meles*] *taxus* Boddaert, Elenchus Animalium, I, p. 80 (Europe).

1789. [*Ursus meles*] *β alba* Gmelin, Syst. Nat., I, 13th ed., p. 102.

1789. [*Ursus meles*] *γ maculata* Gmelin, Syst. Nat., I, 13th ed., p. 102.

1808. *Taxus vulgaris* Tiedemann, Zoologie, I, p. 376 (Renaming of *Ursus meles*).

1816. *Meles europæus* Desmarest, Nouv. Dict. d'Hist. Nat., III, p. 465 (Renaming of *Ursus meles*).

1822. *Taxus meles* F. Cuvier, Hist. Nat. des Mamm., III, fasc. 36, January, 1822.

1827. [*Meles*] *communis* Billberg, Synopsis Faunæ Scandinaviæ, p. 16 (Renaming of *Ursus meles*).

1827. [*Meles communis*] *β caninus* Billberg, Synopsis Faunæ Scandinaviæ, p. 17 (Scandinavia).

1857. *Meles taxus* Blasius, Säugethiere Deutschlands, p. 204.

1894. *Meles meles* Dahl, Die Heimat, IV, p. 125, June, 1894.

1899. *Meles meles typicus* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., IV, p. 384, November, 1899.

1906. *Meles meles britannicus* Satunin, Mitteilungen des Kaukasischen Museums, II, p. 115 (Based on the cranial measurements of English specimens recorded by Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., IV, p. 384). Co-types in British Museum.
1910. *Meles meles* and *M. meles britannicus* Trouessart, Faune Mamm. d'Europe, p. 69.

Type locality.—Upsala, Sweden.

Geographical distribution.—Central and southern Europe from southern Sweden to the Pyrenees and Italy, and from Ireland eastward ; eastern limit of range not known.

Characters.—Skull and teeth moderately large, the teeth rarely attaining maximum size for the species ; colour moderately light, the sides not often conspicuously whitish.

Measurements.—Adult male and female from Woodpark, Galway, Ireland : head and body, 686 and 618 ; tail, 153 and 150 ; hind foot, 108 and 102 ; ear from meatus, 48 and 45. Adult female from Bouconne, Gers, France : head and body, 670 ; tail, 170 ; hind foot, 100 ; ear from meatus, 45. Adult female from Ingelheim, Rheinhessen, Germany : head and body, 672 ; tail, 180 ; hind foot, 104 ; ear from meatus, 50. For cranial measurements see Table, p. 350.

Specimens examined.—Thirty-five, from the following localities :—

Ireland : Woodpark, Galway, 2.

England : Burnley, Lancashire, 1 ; Ross, Hereford, 1 ; Kentchurch, Herefordshire, 4 ; Tetworth, Oxfordshire, 1 ; Ibstone, Buckinghamshire, 1 ; Horsham, Sussex, 1 ; Bicton, Devonshire, 1 ; Cornwall, 1 ; no exact locality, 4.

Norway : Holme, Mandal, 7 ; Egersund, Stavanger, 2.

Sweden : Middle Sweden, no exact locality, 1 (Stockholm) ; Tåkern, Östergötland, 1 (Stockholm) ; Småland, 1 (Stockholm) ; Skåne, 2 (Stockholm) ; no exact locality, 1.

France : Forêt de Bouconne, Gers, 1.

Germany : Ingelheim, Rheinhessen, 1 ; Strass, near Burgheim, Bavaria, 1.

Italy : Liguria, 1 (Genoa).

♂, ♀.	Woodpark, Galway, Ireland.	R. F. Hibbert (P).	95. 6. 2. 1. 95. 12. 3. 1.
		(*Co-types* of *M. m. britannicus*, Satunin.)	
♀.	Burnley, Lancashire, England.	Hon. N. C. Rothschild (P).	0. 10. 31. 4.
♂.	Ross, Herefordshire.	Hon. N. C. Rothschild (P).	0. 10. 31. 3.
♀, 3 juv. st.	Kentchurch, Herefordshire.	W. E. de Winton (C & P).	
♂.	Tetworth, Oxfordshire.	Hon. H. Parker (C & P).	
♂.	Ibstone, Buckinghamshire.	A. H. Cocks (C & P).	4. 1. 25. 1.
♂.	Horsham, Sussex.	E. C. Hawes (C & P).	7. 4. 13. 1.
♀.	Bicton, Devonshire.	J. C. Stagdon (C & P).	97. 2. 23. 1.
1 (albino) skull.	Cornwall.	Lord Lilford (P).	89. 10. 28. 1.
	Sweden.	Purchased (Wheelwright).	64. 3. 8. 1.
4 ♂, 2 ♀.	Holme, Mandal, Norway.	R. J. Cuninghame (C & P).	8. 8. 9. 7–12.
2 skulls.	Egersund, Stavanger.	K. H. Schaanning (C).	11. 6. 3. 13. 11. 10. 23. 2.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Mastoid breadth.	Interorbital breadth.	Rostral breadth over canines.	Depth of brain-case.	Palatal depth behind tooth-rows.	Depth of rostrum at front of nasals.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
M. meles meles.														
Sweden: no exact locality .	64. 3. 8. 1	♀	123·0	72·4	60·2	27·4	29·0	36·0	31·2	20·2	84·0	41·0	48·0	Teeth not worn.
middle Sweden .	Stockholm	♂?	127·2	84·0	62·8	31·0	32·2	42·0	35·0	21·6	88·4	44·2	51·2	,, slightly worn.
Täkern . . .	,,	♂?	127·4	80·8	60·4	29·8	32·0	41·4	34·8	22·2	89·0	42·4	51·4	,, moderately worn.
Småland . .	,,	♀?	124·2	74·6	59·4	31·4	30·0	40·6	34·6	19·0	85·0	41·8	48·6	,, slightly worn.
Skåne . . .	,,	♂?	132·0	80·0	62·2	29·6	33·2	37·8	34·2	21·0	90·0	44·8	52·2	,, much worn.
,, . .	,,		124·4	75·8	60·4	31·0	30·0	—	32·8	21·0	84·4	41·0	48·2	,, ,,
Norway: Holme, Mandal .	152622	♂	117·8	72·4	57·0	—	27·8	37·2	35·4	—	82·6	39·2	46·0	,, slightly worn.
,, ,, .	8. 8. 9. 9	♂	121·4	69·4	57·0	28·8	28·4	37·0	31·6	18·2	83·6	39·2	46·6	,, ,,
,, ,, .	8. 8. 9. 10	♂	118·4	72·2	57·4	29·2	28·2	37·0	32·6	18·8	82·8	40·2	45·8	,, ,,
,, ,, .	8. 8. 9. 11	♂	114·2	70·4	55·4	27·8	27·2	36·0	31·6	18·6	79·0	38·0	45·2	,, moderately worn.
,, ,, .	8. 8. 9. 12	♀	116·0	—	55·4	26·6	27·0	36·4	30·2	—	80·2	39·0	46·0	,, slightly worn.
Stavanger .	11. 6. 3. 13.		122·4	81·6	60·0	32·6	30·2	38·6	33·0	21·8	84·4	39·8	46·8	,, ,,
England: Ross, Hereford .	0. 10. 31. 3	♂	126·0	85·0	61·4	33·6	32·0	39·0	38·0	21·0	89·0	42·4	48·0	,, ,,
Cornwall . .	89. 10. 28. 1	♀?	122±	77·0	60·8	31·8	28·6	40·0	35·6	21·0	87·4	42·4	49·4	,, moderately worn.
no exact locality .	211*b*	♂?	127·6	84·0	61·2	32·4	30·6	40·4	36·8	21·2	87·2	43·0	48·8	,, much worn.
,, ,, .	512238	♀?	121·4	74·8	58·6	29·2	31·4	40·6	33·8	19·0	84·2	41·8	51·4	,, moderately worn.

Ireland: co. Clare . .	95. 12. 3. 1		124·2	83·2	60·6	—	30·0	41·8	—	—	88·2	43·0	52·0	Teeth moderately worn.	
Denmark: Zealand . .	Andersen	♂	132·0	86·0	64·4	32·0	33·4	42·0	34·2	—	88·4	43·8	51·4	,,	much worn.
France: Bouconne, Gers .	8. 7. 15. 5	♀	123·6	75·2	57·6	28·0	29·0	38·4	34·2	19·2	86·0	41·0	49·0	,,	slightly worn.
Germany: Ingelheim, Rheinhessem . .	8. 11. 2. 16	♀	127·2	75·8	63·4	—	30·2	38·6	—	—	87·8	44·0	51·0	,,	,,
Switzerland: Chermingen, Valais .	Mottaz	♂	137·6	86·6	65·4	32·0	33·6	39·4	36·0	—	96·0	45·0	53·0	,,	,,
Italy: Liguria . . .	33 Genoa	♀	130·4	83·2	63·6	28·2	32·8	40·2	34·6	—	91·6	43·2	50·6	,,	moderately worn.
M. meles marianensis.															
Spain: Quintanar, Burgos .	8. 7. 7. 19	♂	127·6	82·0	61·0	28·4	31·0	36·0	36·0	—	89·6	43·0	51·0	,,	,,
Seville . . .	95. 3. 3. 7*	♂	128·0	82·0	60·4	31·6	32·4	37·8	36·4	21·8	91·0	45·0	53·4	,,	slightly worn.
,, . . .	95. 3. 3. 8	♀	119·0	73·4	52·4	28·6	27·8	35·0	32·0	18·0	83·0	42·4	50·0	,,	,,
Coto Doñana, Huelva	8. 3. 8. 6	♂	125±	75·4	61·0	—	32·0	—	34·6	—	88·4	44·2	52·8	,,	,,
,, ,,	8. 3. 8. 7	♀	120±	70·0	57·4	29·0	29·2	—	33·2	—	88·0	43·2	51·2	,,	,,
M. arcalus.															
Crete	5. 12. 2. 17†	♀ juv.	100·0	55·6	48·6	21·0	22·8	34·0	27·6	16·0	68·0	36·0	42·6	,,	not worn.
,, ...	5. 12. 2. 38.	ad.	—	—	—	—	27·2	—	32±	17·8	—	36·8	—	,,	moderately worn.

* Type of *mediterraneus* Barrett-Hamilton. † Type.

♀.	Forêt de Bouconne, Gers, 250 m. France. (*A. Robert.*)	O. Thomas (P).	8. 7. 15. 5.
♀.	Ingelheim, Rheinhessen, Germany.	C. Hilgert (C).	8. 11. 2. 16.

Meles meles marianensis Graells.

1897. [*Meles taxus*] var. *marianensis* Graells, Mem. Real Acad. Cien., Madrid, XVII, p. 170 (Central Spain).

1899. *Meles meles mediterraneus* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., IV, p. 384, November, 1899 (Seville, Spain). Type in British Museum.

1910. *Meles meles mediterraneus* Trouessart, Faune Mamm. d'Europe, p. 70.

Type locality.—Central Spain.

Geographical distribution.—Iberian Peninsula.

Diagnosis.—Skull and teeth large, the teeth frequently attaining maximum size for species; colour light, the sides often conspicuously whitish, especially in region bordering dark ventral area.

Measurements.—For cranial and dental measurements see Table, p. 351.

Specimens examined.—Seven, from the following localities in Spain: Arrechavaleta, Vitoria, 1; Quintanar de la Sierra, Burgos, 2; near Seville, 2; Coto Doñana, Huelva, 2.

Remarks.—Although not very strikingly differentiated, the large-toothed, pallid, Iberian badger seems worthy of recognition as a geographical race.

♂.	Arrechavaleta, Vitoria, Spain.	N. Gonzalez (C).	8. 7. 7. 18.
♂, ♀.	Quintanar, Burgos.	Rev. Saturio Gonzalez (C).	8. 7. 7. 19-20.
♂, ♀.	Seville. (*A. Ruiz.*) (95. 3. 3. 7. *Type* of *mediterraneus* Barrett-Hamilton.)	Lord Lilford (P).	95. 3. 3. 7–8.
♂, ♀.	Coto Doñana, Huelva.	A. Chapman (P).	8. 3. 8. 6–7.

Meles arcalus Miller.

1899. *Meles meles mediterraneus* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., IV, p. 131, November, 1899 (part).

1906. *Meles meles mediterraneus* Bate, Proc. Zool. Soc., London, 1905, II, p. 318, April 5, 1906.

1907. *Meles arcalus* Miller, Ann. and Mag. Nat. Hist., 7th ser., XX, p. 394, November, 1907. Type in British Museum.

1910. *Meles arcalus* Trouessart, Faune Mamm. d'Europe, p. 70.

Type locality.—Lassethe Plain, Crete.

Geographical distribution.—Island of Crete.

Characters.—Size small (upper length of skull in adult less than 110 mm.; maxillary tooth-row, exclusive of incisors, about 35 mm.;

DENTAL MEASUREMENTS OF *MELES MELES* AND *M. ARCALUS*.

Locality.	Number.	Sex.	Upper molar.	Lower molar (first).
M. meles meles.				
Sweden: no exact locality	64. 3. 8. 1	♀	13·0 × 11·4	15·4 × 7·0
Wegelin	Stockholm	♂?	15·0 × 13·0	16·2 × 7·8
Skåne	,,	♂?	15·2 × 13·0	18·0 × 8·2
Ulriksdal	,,	♂ juv.	13·4 × 11·6	15·8 × 7·8
Småland	,,	♀?	14·2 × 11·8	16·2 × 7·4
Örebro	,,	♂ juv.	14·2 × 11·8	15·8 × 7·0
Täkern	,,	♂?	13·6 × 11·2	15·6 × 7·2
Norway: Holme, Mandal	152622	♂	11·6 × 10·4	14·0 × 6·4
,, ,,	8. 8. 9. 9	♂	12·8 × 11·8	14·6 × 7·0
,, ,,	8. 8. 9. 10	♂	12·6 × 11·2	14·6 × 7·0
,, ,,	8. 8. 9. 11	♀	11·2 × 10·8	14·0 × 6·8
,, ,,	8. 8. 9. 12	♀	12·2 × 10·4	14·0 × 7·0
Egersund, Stavanger	11. 6. 3. 13		15·0 × 11·4	14·8 × 7·0
England: Ross, Hereford	0. 10. 31. 3	♂	13·2 × 11·4	16·0 × 8·0
Cornwall	98. 10. 28. 1	♀?	14·0 × 12·0	16·6 × 7·8
no exact locality	211*b*	♂?	13·4 × 12·0	16·4 × 8·0
,, ,,	211*c*	♀?	14·0 × 12·4	16·2 × 8·2
,, ,,	—		14·2 × 12·2	—
,, ,,	—		13·6 × 11·8	—
Burnley, Lancashire	0. 10. 31. 4	♀	14·4 × 12·2	16·2 × 8·2
Cornwall			15·0 × 12·2	18·0 × 8·2
Ireland: Woodpark, Co. Galway	95. 12. 3. 1		15·6 × 12·8	17·0 × 7·8
,, ,,	95. 6. 2. 1		14·8 × 12·2	16·0 × 7·8
Denmark: Zealand	Andersen	♂	14·0 × 13·2	17·0 × 7·8
,,	Copenhagen*	♂	15·0 × 12·6	18·5 × 8·2
,,	,,	♂	15·0 × 13·7	18·3 × 8·3
,,	,,	♂	15·5 × 13·6	18·0 × 9·0
,,	,,	♀	14·6 × 12·5	17·5 × 7·7
various localities, 13 specimens: Maximum	,,		16·3 × 13·6	—
,, ,, Minimum	,,		13·0 × 12·0	—
various localities, 17 specimens: Maximum	,,		—	18·7 × 8·5
,, ,, Minimum	,,		—	15·0 × 7·0
France: Bouconne, Gers	8. 7. 15. 5	♀	14·0 × 12·0	16·2 × 7·2
Germany: Ingelheim, Rheinhessen	8. 11. 2. 16	♀	14·8 × 12·8	18·2 × 7·8
Italy: Borghetto S. Spirito, Liguria	33 Genoa	♀	13·6 × 11·0	15·6 × 7·2
M. meles marianensis.				
Spain: Quintanar, Burgos	8. 7. 7. 19	♂	15·2 × 12·6	17·4 × 8·6
Seville	95. 3. 3. 7†	♂	15·0 × 12·0	16·6 × 7·8
,,	95. 3. 3. 8	♀	14·6 × 12·6	16·8 × 8·2
Coto Doñana, Huelva	8. 3. 8. 6	♂	16·4 × 13·2	17·8 × 8·0
,, ,,	8. 3. 8. 7	♀	14·8 × 12·0	17·6 × 8·2
M. arcalus.				
Crete	5. 12. 2. 17‡	♀ juv.	13·6 × 11·2	15·4 × 7·2
,,	5. 12. 2. 38	ad.	13·8 × 11·6	—

* Measured by H. Winge. † Type of *mediterraneus* Barrett-Hamilton. ‡ Type.

hind foot about 25 mm.); auditory bulla strongly inflated, the highest region near middle of bulla proper (exclusive of meatal tube) and so broadly rounded as not to form a longitudinal ridge, the region between highest portion and meatus not noticeably concave; teeth smaller than in *Meles meles* (lower molars together about 20 mm. in length), with smaller cusps tending to be more strongly developed; metacone of m^1 relatively larger than *M. meles*, so that breadth of crown through this cusp is as great as or greater than that through paracone; colour as in *Meles meles marianensis* or slightly paler.

Measurements.—For cranial and dental measurements see Tables, pp. 351, 353.

Specimens examined.—Four, all from Crete.

♂, ♀.	Lassethe, 2,820 ft.	Crete.	Miss D. Bate (c).	5. 12. 2. 16–17. (5. 12. 2. 17. *Type* of species.)
skull.	Katharo, Crete.		Miss D. Bate (c).	5. 12. 2. 38.
♀.	Crete.		H. O. Jones, R.N. (c).	99. 6. 13. 1.

Sub-Family LUTRINÆ.

1857. *Lutrinæ* Baird, Mamm. North Amer., p. 148.

Geographical distribution.—Nearly cosmopolitan; absent only in the Antarctic and high Arctic regions, Madagascar, Australia and the Pacific Islands.

Characters.—Teeth of the same general type as in the *Melinæ*; skull much flattened, and rostrum so shortened that its length is less than its width; external form long and slender, the fur very dense, the legs unusually short; toes webbed, the claws short or absent; tail long and highly muscular.

Remarks.—The family *Lutrinæ*, the members of which appear to be essentially badgers modified for semi-aquatic life, contains four genera, one of which occurs throughout Europe from Ireland eastward.

Genus **LUTRA** Brisson.

1762. *Lutra* Brisson, Regnum Animale in Classis IX distrib., 2nd ed., p. 13 (*Lutra* Brisson = *Mustela lutra* Linnæus).

1780. *Lutra* Brünnich, Zoologiae Fundamenta, p. 34. First use of name by an author following the Linnæan system (*Mustela lutra*).

1806. *Lutris* Duméril, Zoologie Analytique, p. 12 (Modification of *Lutra*).

1817. *Lutrix* Rafinesque, Analyse de la Nature, p. 59 (Substitute for *Lutra*).

1843. *Lontra* Gray, Ann. and Mag. Nat. Hist., XI, p. 118, February, 1843 (*Lutra canadensis* Schreber).

1843. *Latax* Gray, Ann. and Mag. Nat. Hist., XI, p. 119, February, 1843 (*Lutra lataxina* F. Cuvier). Not *Latax* Glager, 1827.

1843. *Lataxina* Gray, List Spec. Mamm. Brit. Mus., p. 70 (*L. mollis* Gray = *Lutra lataxina* F. Cuvier).

1857. *Lutra* Blasius, Säugethiere Deutschlands, p. 236.

1865. *Barangia* Gray, Proc. Zool. Soc. London, p. 123 (*B. sumatrana* Gray = *Lutra barang* F. Cuvier).

1865. *Lutrogale* Gray, Proc. Zool. Soc. London, p. 127 (*Lutra monticola* Hodgson).

1865. *Nutria* Gray, Proc. Zool. Soc. London, p. 128 (*Lutra felina* Molina).

1867. *Lutronectes* Gray, Proc. Zool. Soc. London, p. 180 (*L. whiteleyi* Gray = *L. lutra* Linnæus?).

Type species.—*Lutra* * Brisson = *Mustela lutra* Linnæus.

Geographical distribution.—Same as that of the sub-family.

Characters.—Skull broad and low (depth of brain-case only about half mastoid breadth), the entire dorsal profile nearly straight, the zygomatic arches so widely expanded and post-orbital region so much narrowed that distance from point of greatest narrowing to zygoma is greater than postorbital constriction; rostrum so shortened that posterior border of narial opening approaches level of anterior zygomatic root, and distance from orbit to gnathion is much less than half length of brain-case; auditory bulla flattened, with conspicuous meatal tube; paroccipital process low and ridge-like but distinct from bulla; dental formula: $i\frac{3\,3}{3\text{-}3}$, $c\frac{1\text{-}1}{1\text{-}1}$, $pm\frac{4\text{-}4}{3\,3}$, $m\frac{1\text{-}1}{2\text{-}2} = 36$; teeth large as compared with width of rostrum and palate (greatest transverse diameter of upper carnassial equal to half distance between carnassials); all of the small premolars opposed and capable of trenchant action with those of opposite jaw; upper carnassial with crown triangular in outline, the outer side occupied by a moderately high cutting edge formed by two cusps and a connecting ridge, the inner side (about half the total crown area) by a flat crushing surface; upper molar rhombic in outline, its crown area about equal to that of carnassial (usually somewhat smaller), its greatest diameter transverse to axis of tooth-row, the four primitive cusps present; lower carnassial with three anterior cusps well developed, sub-equal, the posterior heel slightly larger than anterior triangle; external form highly modified for aquatic life, the body long and of approximately the same width as neck and head, the tail long, very muscular, broad at base, tapering distally, the legs short, feet broad, toes webbed, short-clawed, the fur soft, dense and impervious to water.

Remarks.—Although more widely distributed than any other living genus of land mammals, *Eptesicus* and *Myotis* perhaps excepted, *Lutra* is not rich in species. A dozen or fifteen forms are currently recognized, only one of which occurs in Europe.

LUTRA LUTRA Linnæus.

1758. [*Mustela*] *lutra* Linnæus, Syst. Nat., I, 10th ed., p. 45 (Sweden).

1777. [*Lutra*] *vulgaris* Erxleben, Syst. Regni Anim., I, p. 448 (Renaming of *lutra*).

1792. *M*[*ustela*] *Lutra piscatoria* Kerr, Anim. Kingd., p. 172 (Renaming of *lutra*).

* Not "*Lutra lutra*" (see footnote under *Meles*, p. 341).

1816. ?*Lutra fluviatilis* Leach, Syst. Catal. Spec. Indig. Mamm. and Birds Brit. Mus., p. 6 (nomen nudum: "River Otter").

1827. [*Lutra vulgaris*] *β marinus* Billberg, Synopsis Faunæ Scandinaviæ, p. 28 (Coasts of Scandinavia).

1830. ?[*Lutra*] *fluviatilis* Burnett, Quart. Journ. Sci. Lit. Art. XXVIII, 1829, p. 349 (Substitute for *lutra*), nomen nudum.

1834. [*Lutra*] *nudipes* Melchior, Den Danske Stats og Norges Pattedyr, p. 50 (Coast of northern Norway).

1834. *Lutra roensis* Ogilby, Proc. Zool. Soc. London, p. 111 (Roe Mills, near Newton Lemavaddy, Londonderry, Ireland). Type in British Museum.

1857. *Lutra vulgaris* Blasius, Säugethiere Deutschlands, p. 237.

1884. [*Lutra*] *lutra* Lataste, Actes Soc. Linn. de Bordeaux, XXXVIII, p. 34.

1885. [*Lutra*] *angustifrons* Lataste, Actes Soc. Linn. de Bordeaux, XXXIX, p. 168, August, 1885 (Bône, Algeria). Perhaps in part only: specimen from Liguria, Italy, referred to this form on p. 239, September, 1885. Type in Lataste collection.

1910. *Lutra lutra* Trouessart, Faune Mamm. d'Europe, p. 86.

Type locality.—Upsala, Sweden.

Geographical distribution.—Europe and northern Africa, eastward into Asia; limits of range not known. In Europe west to Ireland and north to the Arctic coast.

Diagnosis.—Size medium (head and body in adult male about 700 mm., condylobasal length of skull, 105 to 123); tail about three-quarters as long as head and body; naked muzzle pad with upper border strongly convex at middle; skull much flattened, the depth of brain-case not conspicuously more than half mastoid breadth; interorbital region narrow, its least width less than distance from front of zygoma to anterior extremity of premaxillary; teeth not specially enlarged, the greatest diameter of upper carnassial not greater than width of palate between carnassials.

External characters.—General form long and slender, the limbs very short, the feet broad, with conspicuously webbed toes, the head short flat and ill-defined from neck, the ears inconspicuous, the tail long, broad at base, tapering toward tip, covered with the same short waterproof fur as body. Head rounded and flattened, not well defined externally from the muscular neck; ear rounded, densely haired on both surfaces, scarcely rising above level of fur, the antitragal lobe valve-like; a second and third valve-like lobe above and behind meatus; muzzle short and wide, the nostril pad entirely naked, its surface reticulate, its upper margin strongly convex at middle, the lower slightly so, its lower border separated from mouth by the densely haired upper lip, the width of which at middle is about equal to height of pad; whiskers stiff and bristly, the longest extending about to ear when laid back. Legs short, feet broad and rounded, with short toes joined by a naked membrane extending to base of terminal phalanges; claws short but strong, non-retractile, those on fore-feet best developed (about 8 mm. in

length); palm bare, a large, heart-shaped, obscurely trilobed tubercular mass behind base of digits, and a round posterior tubercle separated from the larger pad by a deep groove; sole with a bare area and heart-shaped pad essentially as on palm, but with posterior tubercle represented by an ill-defined prolongation of the main pad; posterior portion of sole densely furred. Fur very dense and waterproof, alike in texture throughout the body and tail, the hairs of underfur 10 to 15 mm. in length, the longer overlying hairs, which almost completely conceal the underfur, about 25 mm. in length. Mammæ: 6* (probably *i* 3–3).

Colour.—Winter pelage: upper parts, legs, feet and tail a rich dark brown (about the prout-brown of Ridgway or some-

FIG. 72.
Lutra lutra. Nat. size.

what darker), with a drabby cast more evident in some lights than in others, the hairs with a conspicuous metallic gloss; underfur light grey, the extreme tips of its hairs changing abruptly to prout-brown; on underparts the drab becomes more conspicuous as well as paler, usually assuming a tinge of cream-buff, the throat and cheeks fading to buffy white; interramial region and upper lip with irregular white mottlings, the hairs of which are white to base; whiskers and claws light horn-colour.

The exact colour is subject to considerable variation, but the material examined is not sufficient to show whether such differences as occur are correlated with locality or season.

* Southwell, Field, CII, p. 1043, December 19, 1903.

Sometimes the brown is darker and richer than usual, or the drab may be especially pronounced. Occasionally the long hairs of the back are a light dull buff, imparting to the animal a peculiar faded appearance.

Skull.—General form of skull broad and flattened, more so than in any other European carnivore, the depth of brain-case at middle scarcely more than half mastoid width; the brain-case excessively narrowed anteriorly, broad posteriorly and with greatly

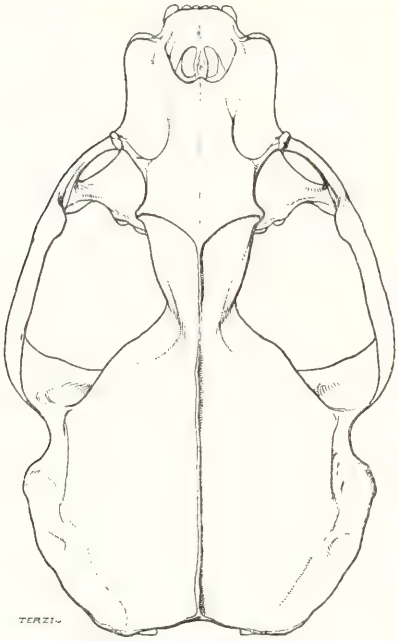

FIG. 73.
Lutra lutra. Nat. size.

developed lambdoid crest, but low though evident sagittal crest; widely spreading zygomata forming a marked contrast with narrow postorbital region; rostrum short, deep and robust. Dorsal profile nearly flat throughout, though region in front of middle of postorbital constriction slopes gradually downward. Owing to depth of rostrum and shallowness of brain-case the dorsal and ventral profiles are approximately parallel. Postorbital processes short but evident, though not forming any considerable portion of border of rather large, somewhat upturned orbit, the greatest diameter

of which nearly equals width of flattened interorbital region. Rostrum short, broad and deep, the distance from front of zygoma to gnathion barely equal to greatest breadth across canines, about equal to depth at front of orbit, and contained about $4\frac{1}{2}$ times in condylobasal length of skull. Zygoma widely spreading throughout, the arch heavy, not much bowed upward, the anterior root conspicuously perforated by the large anteorbital foramen the upper margin with low but evident

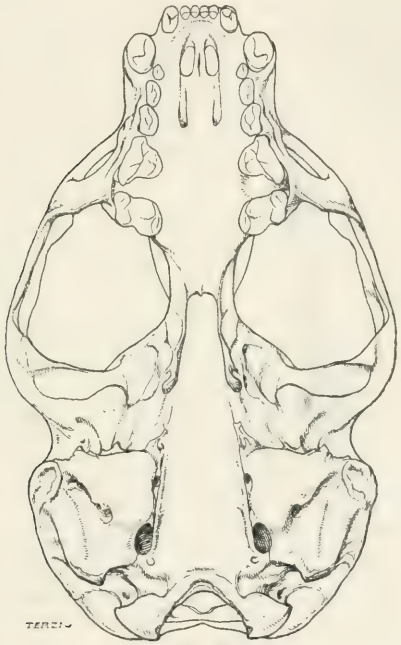

FIG. 74.
Lutra lutra. Nat. size.

angular projection marking posterior border of orbit. Palate rather narrow, the distance between molars contained about three times in that from gnathion to level of posterior border of molar : incisive foramina moderate, about half as wide as long, lying entirely between canines ; posterior extension of palate about equal to distance between molars and about one-third that from molar to hamular ; mesopterygoid space narrow anteriorly, wider posteriorly, its length about double the width between hamulars. Auditory bulla small, flattened, though a little

inflated along inner margin ; outline triangular-flask shaped, the tubular portion of meatus not well defined from rest of bulla ; least distance between bullæ about equal to greatest diameter of bulla including meatus. Paroccipital process low and ridge-like, widely removed from inflated portion of bulla. Mandible very robust, the ramus slightly bowed outward posteriorly, its lower margin essentially straight except for a slight upward curve behind level of tooth-row, the depth of ramus at middle about one-third that through coronoid process ; angular process very short ; coronoid process narrowly rounded off above, its height above articular process about equal to width at articular level.

Teeth.—The teeth are large and strong, with well developed cusps and commissures and relatively small crushing areas, the small premolars of upper and lower mandible fitting closely between each other when jaws are shut; crown area of upper molar about equal to that of carnassial, sometimes less. Upper incisors forming a nearly straight transverse row, the anterior faces of the smaller teeth exactly in line, those of the two larger teeth slightly more posterior ; i^1 and i^2 small, sub-equal, the shafts compressed, the cutting edges rounded, simple ; i^3 higher than the others, somewhat resembling the lower canine in form, its apex curved outward and backward beyond level of smaller teeth, its postero-external surface with two concavities separated by a trenchant ridge ; lower incisors subterete, the crown of i_3 obscurely and unsymmetrically bilobed, that of the others simple ; cross section of i_1 about one-third that of i_3. Canines robust though not greatly elongated ; shaft simple, without evident cingulum, that of upper tooth slightly curved backward, that of lower tooth abruptly recurved, its axis set obliquely outward. Anterior premolar both above and below well developed and functional, the point of the upper tooth lying internal to that of lower when jaws are closed ; pm^1 small, single rooted, its crown area about equal to that i^2, its form essentially like that of succeeding tooth, though with cusp relatively less developed ; pm^2 and pm^3 successively larger, two-rooted, the crown area of pm^3 fully three-fourths that of canine, each tooth with a well-developed cusp lying in front of middle of crown, and a distinct anterior and posterior cutting ridge ; cingulum moderately developed ; outline of crown of pm^2 elliptical, that of pm^3 with inner margin bulging inward behind middle, though without developing a definite inner lobe ; pm_2 and pm_3 much like

FIG. 75.
Lutra lutra. Teeth. Nat. size.

pm^2 in both size and form, the three teeth cutting against each other when jaws are closed; pm_4 larger than the other small premolars, its cusp less anterior in position, its crown decidedly in wider posteriorly than anteriorly. Upper carnassial triangular general outline, though this is somewhat obscured by the broadly rounded inner portion and the somewhat projecting postero-external lobe; outer and posterior borders sub-equal and longest; trenchant portion of tooth with high anterior cusp connected with well developed posterior cusp by a high, abruptly angled commissure; crushing portion nearly as wide as long, its area about as great as that of trenchant portion, its inner border noticeably raised at middle though without secondary cusps; cingulum moderately developed along outer border of crown, and forming a distinct though small antero-basal cusp. Lower carnassial with anterior triangle well developed, the protoconid and paraconid sub-equal, the metaconid somewhat smaller; crushing portion of crown wider than anterior triangle though not so long, the areas of the two portions of the tooth approximately equal; hypoconid evident though not high, the outer surface of its base in line with that of protoconid, the inner surface continuous with the concave though scarcely basin-shaped main portion of crushing area; cingulum narrow but evident throughout, not specially developed in region bordering outer base of hypoconid. Second lower molar flat, subterete, slightly wider than long, the inner and outer margins each with a small cusp somewhat behind middle, the cusps joined by a low transverse ridge. Upper molar about equal to carnassial in crown area, but length of its outer border decidedly less than that of preceding tooth; crown slightly constricted near middle, the outer portion bilobed, the anterior lobe bearing a low paracone and a broad outer projection representing the parastyle, the posterior lobe bearing a low but robust metacone; inner portion of crown with a large protocone and low hypocone, the former sending forward a conspicuous commissure to base of paracone, the latter connected with cingulum that extends around base of protocone.

Measurements.—Adult male from Warwickshire, England: head and body, 712; tail, 495; hind foot, 134; ear, 28. Adult female from Cséhtelek, Hungary: head and body, 640; tail, 380; hind foot, 115; ear, 22. For cranial and dental measurements see Tables, pp. 362, 363.

Specimens examined.—Thirty-three, from the following localities:—

Ireland: Londonderry, 1 (type of *roensis*); Ahascragh, Co. Galway, 1.

England: Pembrokeshire, 1; River Stour, Dorsetshire, 1; Rugby, Warwickshire, 1; Norfolk, 1; no exact locality, 1.

Norway: Egersund, Stavanger, 5.

Sweden: Jockmock, Lappmark, 1 (Stockholm); Gnesta, Södermanland, 1 (Stockholm); Skåne, 1 (Stockholm); no exact locality, 2.

France: St. Gilles, Gard, 1 (Lataste); Étupes, Doubs, 1 (Mottaz).

Germany: Southern Germany, 2.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Mastoid breadth.	Postorbital constriction.	Interorbital constriction.	Rostral breadth over canine.	Occipital depth.	Palatal depth behind tooth-rows.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
Sweden: no exact locality	64. 3. 8. 5	♂ ?	122·0	75·0	67·6	14·2	21·0	28·2	38·3	26·0	78·0	38·2	46·0	Teeth moderately worn.
,, ,,	Stockholm	♂ ?	115±	70·2	64·8	—	19·2	27·0	36·4	23·6	73·4	34·2	42·0	,, not worn.
Jockmock .	,,	♀ !	109 2	66·8	59·6	—	19·4	24·8	34·8	22·2	68·6	34·2	41·0	,, much worn.
Guesta . .	,,	♀ ?	104·6	66·6	56·8	—	17·2	25·0	33·0	22·2	67·2	33·0	40·4	,, slightly worn.
Skåne .	,,	♀ ?	107±	64·6	61·0	—	18·4	25·0	—	23·0	66·4	32·4	39·0	,, not worn.
Norway: Stavanger .	11. 6. 3. 15	♂ ?	120·2	71·6	68·0	13·8	21·8	27·8	35·6	26·2	77·2	36·8	45·8	,, slightly worn.
,, .	11. 6. 3. 17	♂ ?	114·0	70·4	65·6	13·8	19·6	27·2	34·0	24·6	71·2	35·2	43·2	,, ,,
,, .	11. 6. 3. 18	♂ ?	115·2	69·6	65·4	14·4	21·0	26·8	35·8	24·2	72·2	34·6	42·8	,, ,,
,, .	11. 6. 3. 16	♀ ?	105·0	64·8	57·6	14·0	19·2	24·6	32·0	23·0	65·4	33·2	40·6	,, ,,
Ireland . . .	57. 12. 14. 4*		—	—	58·2	14·6	17·0	24·8	—	23·0	66·6	31·0	39·6	,, ,,
England: Warwickshire	9. 12. 16. 1	♀ !	124·0	76·4	—	12·2	21·8	30·2	37·0	26·8	79·6	38·8	46·6	,, moderately worn.
France: Étupes, Doubs.	Mo. 109 Mottaz	♀ !	107·0	67·2	63·0	—	21·0	26·6	34·6	25·0	68·0	34·6	41·0	,, slightly worn.
St. Gilles, Gard	2809 Lataste	♂ !	117·4	71·2	66·8	18·0	20·4	27·2	38·2	25·0	73·4	35·2	43·8	,, not worn.
Germany: Southern Germany .	59. 9. 6. 62	♂ !	122·6	73·2	68·6	13·8	22·8	28·2	38·4	27·6	78·0	35·0	44·0	,, moderately worn.
Austria-Hungary: Karlsbad	57. 2. 14. 1	♀ ?	—	—	—	—	19·0	25·2	—	23·2	68·8	32·2	40·0	,, not worn.
Csáhtelek, Hungary	10. 9. 14. 1	♂	107·4	64·6	59·4	13·2	19·0	26·0	33·8	22·0	66·0	34·0	40·4	,, much worn.
Italy: Torriglia, Liguria	2930 Lataste†	♀ ?	111·6	64·8	60·2	11·2	18·6	26·2	32·6	22·6	71·2	35·6	42·0	,, moderately worn.
Spain: Castrillo, Burgos	8. 7. 7. 17	♀ !	—	—	—	13·0	—	26·4	—	22·6	69·2	32·2	39·8	,, ,,
near Seville .	74. 10. 7. 2	♂ ?	115·0	71·0	65·4	14·4	20·8	29·6	—	27·2	75·0	35·6	43·2	,, not worn.
,, .	76. 3. 4. 1	♂ ?	121·0	75·6	67·4	13·4	20·0	26·6	38·0	26·6	77·8	33·2	45·4	,, slightly worn.
,, .	2. 11. 16. 1	♂ ?	118·0	78·0	69·8	13·8	21·2	28·2	36·6	27·8	79·2	33·6	43·2	,, ,,
Algeria: Bône . .	2531 Lataste‡		115·6	72·6	64·8	12·2	21·0	27·4	35·8	24·0	74·2	35·8	43·6	,, ,,

* Type of *roensis* Ogilby.

† *L. angustifrons*, according to Lataste.

‡ Type of *angustifrons* Lataste.

DENTAL MEASUREMENTS OF *LUTRA LUTRA*.

Locality.	Number.	Sex.	Upper carnassial.	Upper molar.	Lower carnassial.
Sweden: no exact locality	64. 3. 8. 5	♂ ?	12·4 × 9·8	8·8 × 12·8	14·8 × 8·2
,, ,,	Stockholm	♂ ?	10·8 × 8·2	7·8 × 11·0	12·4 × 6·0
Jockmock	,,	♀ !	10·0 × 7·8	7± × 11±	12·6 × 6·6
Gnesta	,,	♀ ?	11·0 × 8·2	7·8 × 11·2	13·2 × 6·2
Skåne	,,	♀ ?	11·0 × 8·0	8·0 × 11·2	12·8 × 6·2
Norway: Stavanger	11. 6. 3. 14	♂ ?	11·6 × 8·8	8·8 × 11·8	13·6 × 6·4
,,	11. 6. 3. 15	♂ ?	12·0 × 9·0	8·8 × 13·0	14·2 × 6·7
,,	11. 6. 3. 17	♂ ?	11·8 × 8·8	9·0 × 12·8	13·8 × 6·2
,,	11. 6. 3. 18	♂ ?	11·4 × 8·4	8·4 × 11·6	13·4 × 6·2
,,	11. 6. 3. 16	♀ ?	10·4 × 7·6	7·8 × 11·0	12·0 × 6·0
Ireland: Londonderry	57. 12. 14. 4*		10·2 × 8·0	7·0 × 10·6	12·6 × 6·0
England: near Rugby, Warwickshire	9. 12. 16. 1	♂	11·2 × 8·8	8·8 × 12·2	14·8 × 6·8
Germany: Southern Germany	59. 9. 6. 62	♂ !	11·2 × 8·8	8·0 × 11·4	13·8 × 6·6
France: St. Gilles, Gard	2809 Lataste†	♂ !	10·8 × 8·8	8·2 × 11·6	13·6 × 7·0
Austria-Hungary: Karlsbad, Bohemia	57. 2. 14. 1	♀ ?	11·0 × 7·6	7·8 × 11·0	12·8 × 6·2
Cséhtelek	10. 9. 14. 1	♀	11·0 × 8·0	7·4 × 11·0	12·8 × 6·2
Italy: Liguria	2930 Lataste	♀ ?	11·0 × 8·2	8·2 × 11·4	13·2 × 6·8
Spain: Castrillo, Burgos	8. 7. 7. 16	♂ juv.	11·4 × 8·4	8·0 × 11·0	12·8 × 6·2
,, ,,	8. 7. 7. 17	♀ !	10·4 × 7·8	7·0 × 11·0	12·4 × 6·0
near Seville	74. 10. 7. 2	♂ ?	11·6 × 8·4	7·8 × 11·2	13·2 × 6·2
,,	76. 3. 4. 1	♂ ?	11·8 × 8·6	8·0 × 12·0	13·0 × 6·6
,,	2. 11. 16. 1	♂ ?	10·6 × 8·0	8·0 × 10·8	12·4 × 6·2
Algeria: Bône	2531 Lataste‡		11·0 × 8·2	8·4 × 11·8	13·2 × 6·6

* Type of *roensis* Ogilby.

† *L. angustifrons*, according to Lataste.

‡ Type of *angustifrons* Lataste.

Austria-Hungary: Karlsbad, Bohemia, 1; Cséhtelek, Bihar, Hungary, 1.
Italy: Torriglia, Liguria, 1 (Lataste).
Spain: Castrillo de la Reina, Burgos, 3 (B.M. and U.S.N.M.); Galicia, 1; Seville, 5.

Remarks.—Although the specimens show some rather noteworthy variations in colour, and in cranial and dental measurements, the material examined is not sufficient to indicate the existence of geographical races in Europe; while the north African animal to which the name *angustifrons* has been applied appears to be not separable from true *lutra*.

1.	Newton Lemavady, Londonderry, Ireland. (*Miss A. Moody.*)	Zoological Society's Museum.	57. 12. 14. 4. (Type of *L. roensis* Ogilby).
♂ st.	Ahascragh, Galway.	Purchased (Rowland Ward).	5. 7. 10. 1.
♀, 3 juv. st.	Pembrokeshire, Wales.	Purchased (Rowland Ward).	5. 5. 21. 1–4.
♂.	Rugby, Warwickshire, England.	Dr. T. S. Townsend (c & p).	9. 12. 16. 1.
♀ st.	R. Stour, Dorset.	J. C. Mansel Pleydell (c & p).	98. 5. 13. 1.
1.	England.	——	99. a.
4 ♂, 1 ♀, skulls.	Egersund, Stavanger, Norway.	K. H. Schaanning (c).	11. 6. 3. 14–18.
ad., juv.	South Germany.	Dr. A. Günther (c).	59. 9. 6. 62-63.
♂.	Cséhtelek, Bihar, Hungary.	Hon. Mrs. N. C. Rothschild (p).	10. 9. 14. 1.
1.	Karlsbad, Bohemia.	Lord O. Russell (c & p).	57. 2. 14. 1.
♂, ♀.	Castrillo de la Reina, Burgos, Spain.	Rev. Saturio Gonzalez (c).	8. 7. 7. 16–17.
1 juv.	Galicia.	Dr. V. L. Seoane (c & p).	94. 6. 18. 1.
skull.	Seville.	Lord Lilford (p).	74. 10. 7. 2. 76. 3. 4. 1.
♀, juv. skull.	Seville. (*Dr. A. Ruiz.*)	Lord Lilford (p).	95. 9. 4. 10–11.
	Seville.	Col. L. H. Irby (c & p).	2. 11. 16. 1.

Sub-Family MUSTELINÆ.

1835. *Mustelinæ* Swainson, Nat. Hist. and Classif. Quadr., p. vii.

Geographical distribution.—Northern hemisphere, south into northern Africa, the Malay Archipelago, and northern and western South America; in Europe west to Ireland.

Characters.—Dentition highly trenchant, upper carnassial without crushing surface other than a small concave area between inner lobe and main cusp, the crown much longer than broad, not triangular or rhombic in outline, the posterior cusp compressed, trenchant, barely half as high as main cusp; upper molar much reduced, the length of its outer portion one-third to one-half that of carnassial; small premolars alternating when jaws are closed, at least one pair capable of shearing action; skull varying in

form but never greatly flattened and never very robust, the rostrum always at least as long as broad ; external form slender, the legs usually rather short ; feet digitigrade ; toes partly webbed ; tail varying in length, slender or bushy, never conspicuously muscular.

Remarks.—As here understood the sub-family *Mustelinæ* contains the three genera, *Martes*, *Mustela* and *Vormela*, all of which occur in Europe.

Genus **MARTES** Pinel.

1792. *Martes* Pinel, Actes Soc. d'Hist. Nat., Paris, 1, p. 55 (*M. domestica* Pinel = *M. foina* Erxleben).
1820. *Martes* Nilsson, Skand. Fauna, 1, p. 38 (*M. foina* and *M. sylvatica* = *martes*).
1829. *Zibellina* Kaup, Entw.-Gesch. u. Natürl. Syst. Europ. Thierw., 1, p. 31 (*M. zibellina*).
1857. *Mustela* Blasius, Säugethiere Deutschlands, p. 211.
1911. *Martes* Thomas, Proc. Zool. Soc., London, p. 139, March, 1911.

Type species.—*Mustela martes* Linnæus.

Geographical distribution.—Northern hemisphere from the limits of tree growth south to the Mediterranean, the Malay Archipelago, and the central United States ; in Europe west to Ireland.

Characters.—Skull narrow, moderately high (depth of braincase much more than half mastoid breadth), the dorsal profile moderately curved, the zygomatic arches not specially widespreading, and postorbital region not unusually narrowed (distance between region of greatest narrowing and zygoma normally less than breadth of postorbital constriction) ; rostrum narrow and somewhat elongate, its width noticeably less than that of interorbital region, the distance from anterior rim of orbit to gnathion exceeding width of rostrum between anteorbital foramina ; auditory bullæ moderately inflated, the meatal tube evident though short, the longitudinal diameter of bulla greatest ; paroccipital process small, slightly projecting, partly distinct from bulla ; dental formula : $i\,\frac{3-3}{3\ 3}$, $c\,\frac{1-1}{1-1}$, $pm\,\frac{4\ 4}{4-4}$, $m\,\frac{1\ 1}{2-2} = 38$; cutting edges of five small premolars (2 upper and 3 lower) capable of trenchant action ; upper carnassial long and narrow, not triangular in outline and without crushing surface, the small inner lobe standing as an offset to antero-internal extremity of crown, the sectorial portion consisting of a high anterior and low posterior cusp with somewhat concave connecting ridge ; upper molar pyriform or pandurate in outline, its long axis nearly perpendicular to that of tooth-row, its crown mainly flat, but with a small paracone, still smaller, sometimes obsolete metacone, and crescentic ridge-like protocone ; lower carnassial wider posteriorly than anteriorly, the anterior triangle much distorted, the metaconid reduced to

a well defined postero-internal process on base of protoconid, the posterior crushing heel slightly more than half as large as trenchant portion of tooth; external form slender, somewhat cat-like or squirrel-like, the head moderately elongated, the muzzle pointed, the ears high and conspicuous, the tail long, bushy; feet digitigrade, the moderately long claws partly retractile; fur long, dense and soft.

Remarks. The genus *Martes* contains about ten species, some of which are represented by numerous geographical races. Three are known from western and southern Europe.

KEY TO THE EUROPEAN FORMS OF *MARTES*.

Third upper premolar with crown strongly convex on inner side, slightly concave on outer side; width of inner lobe of upper carnassial nearly equal to that of trenchant portion of crown; greatest diameter of upper molar about equal to length of outer border of carnassial; fur usually finer and softer, and throat-patch more yellow (Pine Martens) ..... *M. martes*, p. 366.
Throat-patch cream-buff, general colour darker (Central and northern Europe)... *M. m. martes*, p. 372.
Throat-patch buff-yellow, general colour lighter (Mediterranean region) ..... *M. m. latinorum*, p. 373.
Third upper premolar with crown evenly biconvex; width of inner lobe of upper carnassial barely half that of trenchant portion of crown; greatest diameter of upper molar noticeably less than length of outer border of carnassial; fur usually coarser and less soft, and throat-patch more whitish (Beech Martens).
Condylobasal length of skull in adult male, 76 to 79 mm.; pale throat patch always much encroached on by brown of surrounding parts, occasionally obliterated (Crete) ..... *M. bunites*, p. 380.
Condylobasal length of skull in adult male, 79 to 84 mm.; pale throat-patch seldom much encroached on by brown of surrounding parts and never obliterated (Central and southern Continental Europe) ..... *M. foina*, p. 374.
General hue of upper parts drab ..... *M. f. foina*, p. 375.
General hue of upper parts wood-brown .. *M. f. mediterranea*, p. 380.

MARTES MARTES Linnæus.

(Synonymy under subspecies.)

Geographical distribution.—Entire wooded region of Europe, from Ireland eastward into Asia, and from the Mediterranean coast and islands northward to the limits of tree growth.

Diagnosis.—Third upper premolar with outline of crown

concave on outer side, irregularly convex on inner side, the region of greatest width behind middle; upper carnassial with inner projection robust, its diameter in line of tooth-row nearly or quite equal to greatest width of trenchant portion of tooth behind middle of crown; upper molar large, its greatest diameter about equal to outer length of carnassial, the metacone more than half as large as paracone, the outer border of the crown usually notched; general colour yellowish brown, the throat patch

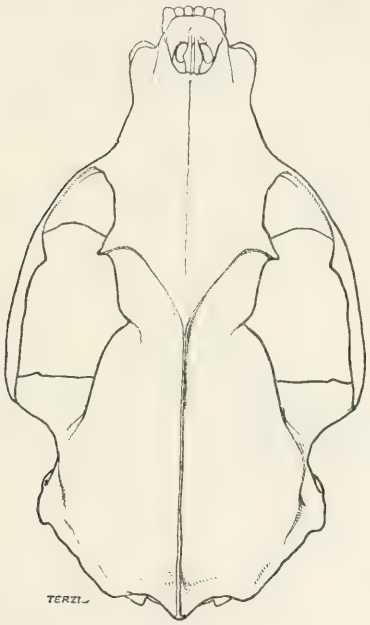

FIG. 76.
Martes martes. Nat. size.

always distinctly tinged with yellow; underfur moderately long and dense.

External characters.—Form slender and graceful, suggesting that of both cat and squirrel; legs moderately long; tail about half head and body, densely furred and bushy, the hairs at tip about one-third as long as vertebræ. Head pointed; eyes of medium size; ear rising distinctly above fur, its height from crown about 25 mm., the outline rounded but forming a slightly indicated point above, the entire surface densely furred; muzzle pad

well defined, completely naked, communicating with upper lip by narrow median line. Feet densely furred throughout in winter, the pads bare in summer; palm with deeply divided, trilobed, heart-shaped tubercular mass at bases of median digits, a small round pad at base of thumb, and a larger round pad at outer posterior border near wrist; sole with similar trilobed mass, but elements more distinct, almost forming three tubercles; small pad at base of hallux like that at base of thumb; no posterior pad. Fur very dense and soft, the hairs of underfur about 25 mm. long at middle of back in winter, shorter in summer, the longer hairs reaching about 40 mm. Mammæ: 4.

Colour.—The colour varies considerably with season and climate, but is usually characterized by rich yellowish brown and blackish tints, the legs, tail and underparts darker than the back, the head noticeably lighter than the body, the throat and fore part of chest yellowish, and interramia, chin and muzzle dusky. Claws light horn-colour.

Skull.—As compared with that of the European species of *Mustela* the skull of *Martes martes* is characterized by a general

FIG. 77.
Martes martes. Nat. size.

smoothness, lightness and lack of angularity. Dorsal profile strongly convex posteriorly, flattish behind orbits, the rostrum falling away at an angle of about 20°; a slight concavity usually present near middle of nasals. Brain-case elongate-ovate in outline when viewed from above, nearly as deep as wide, the

sagittal crest moderately developed in old individuals and slightly overhanging occiput. Floor of brain-case with no special features; a slightly developed median ridge. Auditory bullæ moderately inflated, the surface smooth, the general outline broadly flask-shaped (longitudinal diameter greatest), the meatal tube well defined, rather wider than long; space between bullæ about equal to diameter of bulla without tubular portion. Postorbital region rather abruptly constricted, much as in *Mustela*, its width about half that of brain-case. Interorbital

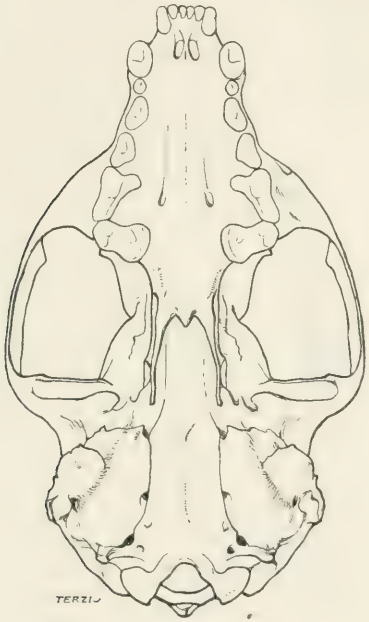

FIG. 78.
Martes martes. Nat. size.

region wider than rostrum, the discrepancy in breadth greater than in *Mustela erminea*. Postorbital processes well developed though short. Rostrum relatively longer than in *Mustela erminea* or *M. putorius*, the distance from orbit to gnathion about equal to width between outer margins of anteorbital foramina, the width across canines much less than distance from foramen to gnathion. Orifice of anteorbital foramen over anterior root of carnassial, and under anterior border of rather large orbit. Zygamata rather widely but gradually spreading, strongly bowed

upward behind middle. Palate rather narrow, its width between molars equal to about $1\frac{1}{2}$ times greatest diameter of molar, incisive foramina small, ovate, slightly oblique, at level of front of canine, the minute median foramen slightly behind middle; posterior extension of palate broader than long, reaching about half way from level of molar to hamular; mesopterygoid space about a quarter longer than broad, the hamulars short, slightly everted.

Teeth.—In proportion to size of skull the teeth are larger than in the members of the other genera of *Mustelinæ* occurring in Europe; transverse diameter of upper molar much more than half width of palate between molars. Upper incisors forming a straight row separated at each side from canine by a space about equal to transverse diameter of i^1 and i^2 together: crowns strongly compressed, the antero-posterior diameter fully twice transverse diameter, the anterior face convex, the posterior concave with faintly indicated cingulum; i^2 slightly larger than i^1, i^3 abruptly much larger than the other two teeth together, its crown more than one-third as high as that of canine and with the posterior concavity extending to outer basal portion. Mandibular incisors smaller and lower than the upper teeth, their crowns projecting obliquely forward, the root of i_2 implanted in jaw behind level of the other two; crowns obscurely bifid, the outer lobe smaller than the inner; crown area of i_1 about one-third that of the compressed i_2 or the subterete i_3. Canines with no special peculiarities; diameter of the upper tooth along alveolus equal to one-half width of palate between canines, that of lower somewhat more; shaft of upper tooth with posterior longitudinal ridge, and an antero-internal ridge which near base curves backward across inner side of shaft nearly to base of posterior ridge; cingulum barely indicated; shaft of lower canine directed a little forward at base, a little backward beyond middle, the anterior profile strongly convex, the posterior equally concave; surface of enamel, especially on basal half of tooth, much roughened by longitudinal wrinkles. Anterior premolar both above and below single-rooted, small (crown area about equal to that of i^1 and i^2 together), subterete, the height of the single ill-developed cusp scarcely equal to diameter of crown in pm^1, much less in pm_1. Other premolars, except upper carnassial, two-rooted, compressed, the outline of crown triangular when viewed from the side, with apex slightly in front of middle of tooth. Crown area of pm^2 about three times that of pm^1; outline of crown flattened-elliptical

FIG. 79.
Martes martes. Teeth. Nat. size.

or slightly concavo-convex, the concavity, when present, on outer side; cusp simple, its height a little less than length of crown along base, its posterior surface with slightly developed longitudinal ridge. Crown of pm^3 somewhat longer than that of pm^2, but its area much greater owing to widening of strongly convex inner side; cusp essentially as in pm^2 though somewhat higher. Second lower premolar about equal in size to pm^2, but axis of shaft more anterior in position; pm_3 essentially like pm_2, but cusp with faintly indicated anterior longitudinal ridge, and posterior ridge with a slight nodule or rudimentary basal cusp (sometimes absent); pm_4 noticeably larger than pm_3 and with a well developed secondary cusp at middle of posterior border of main cusp. Upper carnassial (pm^4) long and narrow, the width of crown just behind internal lobe less than half length along outer border, the internal lobe robust, its diameter in line of tooth-row nearly or quite equal to width of trenchant portion of crown, its axis nearly perpendicular to main axis of tooth, its cusp well developed, about as high as that of pm^1, and separated from main cusp by deep concavity; main cusp robust, its height contained about $1\frac{2}{3}$ times in length of crown, its axis slanting a little backward, its anterior border with well developed longitudinal ridge; posterior cusp about half as high as main cusp, its outer surface sloping obliquely to well developed cingulum, the two cusps connected by a high, sharply trenchant and obtusely angled commissure. Lower carnassial with crown nearly $2\frac{1}{2}$ times as long as broad, the sectorial portion of the tooth consisting of a much distorted triangle, the paraconid forming anterior extremity of tooth, its anterior border nearly perpendicular, its posterior commissure meeting anterior commissure of the higher protoconid at an abrupt angle, the two together acting in opposition to the angled commissure of upper carnassial; metaconid reduced to a subterete postero-internal process on base of protoconid, its area scarcely one-sixth that of larger cusp; crushing portion of crown slightly broader than trenchant portion, its outline sub-circular with slightly raised edge, this edge forming a noticeable though low postero-external cusp separated from base of protoconid by a shallow but distinctly angled notch. Second lower molar about equal to heel of carnassial in size and essentially like it in form, the crown flat, with faintly indicated outer ridge and low postero-internal cusp. Upper molar large, its crown area at least equal to that of carnassial, its greatest diameter about equal to outer length of carnassial (see measurements, p. 378), the diameter of inner portion of crown usually much greater than that of outer portion, the median constriction well marked; outer portion of crown with two small cusps, probably the paracone and metacone, the latter more than half as large as former, the outer margin of tooth often though not invariably notched between them; inner portion of crown with a slightly curved, ridge-like antero-

external cusp (usually notched or partly divided into two), the surface elsewhere finely wrinkled; in some specimens a minute tubercle, perhaps representing the hypocone, occurs near posterior border of crown in region of constriction between outer and inner portions; cingulum low but evident, especially around inner margin of crown.

Remarks.—The well-known pine marten is so strongly characterized as to require no special comparisons with any other European species except *Martes foina* (see account of latter). Two geographical races are currently recognized, though their status is by no means clear.

Martes martes martes Linnæus.

1758. [*Mustela*] *martes* Linnæus, Syst. Nat., I, 10th ed., p. 46 (Sweden).
1816. *M*[*ustela*] *sylvestris* Oken. Lehrb. d. Naturgesch., III, pt. 2, p. 1029 (Renaming of *martes*).
1827. *M*[*artes*] *vulgaris* Griffith, Cuvier's Anim. Kingd., V, p. 123 (Renaming of *martes*).
1847. *Martes sylvatica* Nilsson, Skand. Fauna, I, 2nd ed., p. 41 (Renaming of *martes*).
1857. *Mustela martes* Blasius, Säugethiere Deutschlands, p. 213.
1910. *Mustela martes* Trouessart, Faune Mamm. d'Europe, p. 72.
1911. [*Martes*] *martes* Thomas, Proc. Zool. Soc. London, p. 139, March, 1911.

Type locality.—Vicinity of Upsala, Sweden.

Geographical distribution.—Europe north of the Mediterranean region, from Ireland eastward into Asia.

Diagnosis.—Throat patch cream-buff or slightly more yellow.

Colour.—Upper parts a rich dark brown, usually rather near the bister of Ridgway, the tips of the longer hairs blackish; underfur light grey, the tips of the hairs tinged with drab or with wood-brown; face essentially like back or not so dark, the muzzle and chin usually not darker than forehead; ear edged with buffy drab; tail very dark brown (nearly the seal-brown of Ridgway), its underfur raw-umber or somewhat darker; feet and lower portion of legs blackish; throat-patch varying considerably, but as a rule rather pale, nearly cream-buff or slightly more yellow.

Measurements.—For cranial and dental measurements see Tables, pp. 376, 378.

Specimens examined.—Twenty, from the following localities:—
Ireland: Kenmare, Kerry, 1; Co. Kerry, no exact locality, 1.
Scotland: No exact locality, 1.
England: Keswick, Cumberland, 1; Cockermouth, Cumberland, 1; Pontrilas, Herefordshire, 1; Ludford Park, Herefordshire, 1; no exact locality, 3 (B.M. and U.S.N.M.).
Norway: Egersund, Stavanger, 3.
Sweden: No exact locality, 3 (U.S.N.M.).
Denmark: No exact locality, 1 (U.S.N.M.).
Germany: Southern Germany, 2.
Austria-Hungary: Bohemia, 1.

♀.	Kenmare, Kerry, Ireland.	E. Dodson (c).	94. 3. 27. 1.
1.	Kerry.	J. H. Gurney (p).	72. 1. 10. 1.
1.	Scotland. (*McLeay.*)	Hargitt Collection.	86. 9. 9. 1.
st.	Keswick, Cumberland, England.	W. R. Wilson (c).	96. 11. 6. 1.
♂.	Cockermouth, Cumberland.	W. R. Wilson (c).	97. 1. 15. 1.
♂.	Pontrilas, Herefordshire.	Mrs. St. John A. Matthews (p).	85. 6. 10. 1.
♂.	Ludford Park, Herefordshire.	H. J. Bailey (c & p).	0. 2. 23. 1.
2.	Wales (1828).	Earl Cawdor (p).	61. c. d.
2 ♂, 1 ♀, skulls.	Egersund, Stavanger, Norway.	K. H. Schaanning (c).	11. 6. 3. 19–21.
2 skulls.	Southern Germany.	Dr. A. Günther (c).	188i, 1299f.
♂.	Bohemia.	Lord O. Russell (c & p).	50. 12. 23. 1.

Martes martes latinorum Barrett-Hamilton.

1904. *Mustela martes latinorum* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., xiii, p. 389, May, 1904 (Nurri Mountains, Sardinia).
1910. *Mustela martes latinorum* Trouessart, Faune Mamm. d'Europe, p. 72.

Type locality.—Nurri Mountains, Sardinia.

Geographical distribution.—Mediterranean region (Italy, Sardinia, Balearic Islands).

Diagnosis.—Throat patch buff-yellow; general colour lighter than in true *martes*.

Colour.—Upper parts a rather light brown, the longer hairs between the raw-umber and mars-brown of Ridgway, the general effect darker in certain lights, especially on posterior half of body; underfur a pale bluish grey, essentially as in true *martes*, the tips of the hairs ranging from pale wood-brown to clear buff; face isabella-colour streaked with whitish hairs, the muzzle and lips between mars-brown and prout-brown; ear edged with buffy drab; tail like back at base, darker at tip; feet and legs washed with dark brown; throat-patch varying considerably, but as a rule approaching buff-yellow.

Measurements.—Adult male from Porlezza, Como, Italy: head and body, 470; tail, 235; hind foot, 94·6; ear from meatus, 42. Adult female from San Cristobal, Minorca, Balearic Islands: head and body, 430; tail, 230; hind foot, 87; ear from meatus, 45. For cranial and dental measurements see Tables, pp. 376, 378.

Specimens examined.—Nineteen, from the following localities:—
Italy: Porlezza, Como, 11 (Ghidini); near Rome, 4; Milan, 1.
Sardinia: Nurri Mountains, 1 (type).
Spain: Mancor, Majorca, Balearic Islands, 1; San Cristobal, Minorca, 1.

Remarks.—The status of this form is very unsatisfactory. So far as can be judged from the few specimens examined there is

an average difference, however, between the Mediterranean animal and that occurring north of the Alps. Two of the specimens from Porlezza are darker than the others, in this respect agreeing with the northern animal.

1.	Italy. (*C. Coli.*)	G. Barrett-Hamilton (P).	11. 1. 2. 29.
1.	Milan.	E. Cavendish Taylor (P).	5. 5. 6. 8.
1.	Nurri Mountains, Sardinia.	E. N. Buxton (P). (*Type* of subspecies.)	95. 4. 16. 1.
♀.	Mancor, Majorca, Balearic Islands. (*Riutort.*)	O. Thomas (P).	1. 3. 6. 1.
♀.	San Cristobal, Minorca.	O. Thomas & R. I. Pocock (C & P).	0. 7. 1. 43.

MARTES FOINA Erxleben.

(Synonymy under subspecies.)

Geographical distribution.—Central and southern Continental Europe, from the Atlantic coast eastward, and from the Mediterranean to the Baltic.

Diagnosis.—Third upper premolar with outline of crown nearly biconvex, the outer side occasionally flattened, the greatest transverse diameter at middle; upper carnassial with inner lobe slender, its diameter in line of tooth-row equal to only about half greatest width of trenchant portion of tooth behind middle of crown; upper molar not so large as in *M. martes*, its greatest diameter less than outer length of carnassial, the metacone less than half as large as paracone; external form as in *M. martes*, but fur of less fine quality; colour usually more greyish or drab than in *M. martes* and seldom with the rich brown tints of the related species, the throat-patch never strongly tinged with yellow. Mammæ: 4.

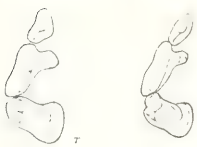

FIG. 80.

Larger cheek-teeth of *Martes martes* (*a*) and *M. foina* (*b*). Nat. size.

Skull.—The skull resembles that of *Martes martes*, but may usually be distinguished by its greater breadth and less depth. Brain-case noticeably wider than high, the general outline when viewed from behind nearly as in *Mustela erminea* and distinctly less elevated than in *Martes martes*. Interorbital region and rostrum wider than in *Martes martes*, and concavity of dorsal profile in nasal region much more pronounced. Anteorbital foramen usually smaller than in the related species, though in the same position. In other respects the skulls of the two animals show no tangible differences.

Teeth.—Except as already pointed out the teeth agree with those of *Martes martes*.

Remarks.—Though readily distinguishable from *Martes martes* by the character of the skull and teeth *M. foina* is sometimes difficult to recognize by external peculiarities alone. Usually the colour has a slaty or drab cast that is highly characteristic, and the quality of the fur is inferior to that of the pine marten; but I have seen tanned skins of animals killed in winter which were impossible to identify with any degree of certainty.

Two geographical races have been described.

Martes foina foina Erxleben.

1777. [*Mustela*] *foina* Erxleben, Syst. Regni Anim., I, p. 458 (Germany).
1792. *Martes domestica* Pinel, Actes Soc. d'Hist. Nat., Paris, I, p. 55 (France).
1801. *M*[*ustela*] *f*[*oina*] *alba* Bechstein, Gemeinn. Naturgesch. Deutschlands, I, 2nd ed., p. 759 (Thüringen, Germany).
1857. *Mustela foina* Blasius, Säugethiere Deutschlands, p. 217.
1869. *Mustela martes* var. *fagorum* Fatio, Faune Vert. Suisse, I, p. 318 (Sweden): name wrongly attributed to Linnæus, Syst. Nat., I, 12th ed., p. 67.
1910. *Mustela foina* Trouessart, Faune Mamm. d'Europe, p. 72.

Type locality.—Germany.

Geographical distribution.—Range of the species except southern Spain.

Diagnosis.—Longer hairs of back tipped with sepia, the general hue of upper parts drab.

Colour.—Underfur very light grey (about grey No. 10 of Ridgway) with an evident buffy cast on distal third of hairs; long hairs ranging from wood-brown to mars-brown, becoming darker at tips. As the long hairs nowhere conceal the underfur the general effect is a light drab resulting from the blending of the two colours, very uniform throughout dorsal surface, though usually a little paler on neck and darker on posterior portion of back. Tail essentially like body, but darkening toward tip, the pencil often blackish. Legs and feet washed with dark brown. Ear buffy drab externally, creamy white along rim, the inner surface greyish white. Muzzle, lips and chin broccoli-brown. Throat-patch buffy white, darkening to cream-buff along outer edges.

Measurements.—Adult male from near St. Gallen, Switzerland: head and body, 453; tail, 260; hind foot, 85; ear from meatus, 34. For cranial measurements see Table, p. 377.

Specimens examined.—Twenty-three, from the following localities:—
France: Manonville, Meurthe-et-Moselle, 2.
Germany: Ingelheim, Rheinhessen, 2; Nuremberg, Bavaria, 1 (U.S.N.M.); southern Germany, 7 (skulls).
Switzerland: Geneva, 1 (Mottaz); Vallée-de-Joux, Vaud, 1 (Mottaz); Thayngen, Schaffhausen, 3 (B.M. and U.S.N.M.); Aarburg, Aarau, 1 (U.S.N.M.); Oberrich, St. Gallen, 1.
Spain: Silos, Burgos, 1; Doñasantos, Burgos, 1 (U.S.N.M.).
Italy: Near Rome, 1.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Mastoid breadth.	Interorbital breadth.	Rostral breadth over canines.	Depth of brain-case.	Palatal depth behind tooth-rows.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
M. martes martes.													
Scotland: no exact locality .			—	—	42·4	—	19·0		25·4	61·0	29·6	38·0	
England: Cockermouth, Cumberland .	97. 1. 15. 1	♂ juv.	83·4	49·0	40·2	21·4	18·0	28·8	24·0	-	27·8	- -	Teeth not worn.
,, ,, .	175 Grant	♂	86·4	53·8	41·2	23·0	18·2	28·6	25·2	59·0	29·8	36·0	,, moderately worn.
Keswick . .	6. 2. 24. 1	♂	—	52·0	42·0	22·2	19·0	27·4	25·0	57·2	30·0	36·8	,, slightly worn.
Sweden	1291 U.S.N.M.	♂?	88·0	47·6	37·6	20·0	17·4	28·8	23·8	60·0	30·4	37·8	,, ,,
Denmark	1964 U.S.N.M.	♀?	81·6	47·2	38·4	21·8	16·4	26·0	22·0	52·8	28·2	33·4	,, much worn.
Bohemia: no exact locality .	50. 12. 23. 1	♂	—	51·2	—	22·8	18·4	—	23·2	58·4	31·0	36·6	,, slightly worn.
M. martes latinorum.													
Italy: Porlezza, Como . .	Ghidini	♂	85·0	52·0	39·0	—	18·8	30·0	—	57·4	31·2	37·0	,, moderately worn.
,, ,, . .	,,	♂	88·0	52·0	38·0	—	18·0	—	—	59·6	31·4	37·6	,, much worn.
,, ,, . .	,,	♀	80·0	44·4	37·0	—	15·4	28·0	24·4	52·0	28·0	33·0	,, slightly worn.
,, ,, . .	,,	♀	77·0	43·0	36·0	—	16·2	28·2	22·0	50·0	28·2	32·2	,, moderately worn.
Austria-Hungary: Valle di Sole, Trentino	Genoa	♀	77·4	45·4	36·0	—	16·4	26·0	22·0	51·0	27·2	32·0	,, slightly worn.
Sardinia	95. 4. 16. 1*	♂	87·0	52·4	41·4	21·8	18·6	29·0	25·0	—	30·0	—	,, ,,
,, ...	Genoa	♀	83·0	47·0	38·0	—	16·6	27·0	24·0	55·4	29·6	34·0	,, ,,

Spain: San Cristobal, Minorca, Balearic Islands	0.7.1.43	♀	79·2	49·2	38·8	—	17·0	26·0	22·2	54·4	29·0	34·0	Teeth slightly worn.
Inca, Majorca, Balearic Islands	1.3.6.1	♀	77·0	44·0	36·6	—	15·4	27·6	21·2	51·2	27·0	33·2	,, not worn.
M. foina foina.													
Spain: Silos, Burgos	8.7.7.21	♂ (juv.)	80·0	48·0	38·0	21·2	17·2	27·0	22·4	52·0	27·0	33·0	,, ,,
France: Manonville, Meurthe-et-Moselle	95.9.5.1	♀	80·0	50·0	39·4	21·8	17·0	27·0	22·0	53·4	27·4	33·0	,, slightly worn.
Germany: Ingelheim, Rhein-hessen	8.11.2.17	♂	84·6	54·8	42·2	23·2	19·2	28·6	23·2	57·2	29·2	35·0	,, moderately worn.
Southern Germany	1299*b*	♂	82·0	52·0	39·2	—	17·4	27·0	23·8	55·0	27·0	34·0	,, ?
,, ,,	1299*d*	♀	78·0	48·8	35·8	20·6	16·4	27·4	21·4	52·4	26·4	32·2	,, slightly worn.
,, ,,	1299*e*	♀	79·0	48·0	38·6	19·6	16·4	27·0	21·4	52·4	27·2	32·6	,, not worn.
Nuremberg, Bavaria	1850 U.S.N.M.	♀?	77·6	46·2	38·0	20·8	16·6	26·6	22·4	52·0	26·4	32·0	,, ,,
Switzerland: Geneva	2566 Mottaz	♂	79·0	54·0	39·2	22·8	18·4	29·2	24·6	54·0	28·6	34·0	,, slightly worn.
Vallé-de-Joux, Vaud	1319 Mottaz	♂	84·0	52·0	39·0	22·0	17·4	29·0	25·2	56·4	30·0	35·0	,, ,,
M. foina mediterranea.													
Spain: Sierra de Jerez	98.3.18.1*	juv.	—	48·4	38·0	21·0	17·0	—	22·0	53·0	27·6	33·4	,, not worn.
M. bunites.													
Crete	5.12.2.18	♂	76·0	50·0	37·4	19·2	16·6	26·0	21·4	50·4	26·4	32·2	,, moderately worn.
,,	5.12.2.22*	♂	78·4	50·0	39·0	20·4	16·0	27·4	23·0	53·4	27·2	33·8	,, not worn.
,,	5.12.2.21		—	—	—	19·0	15·4	—	20·2	50·2	25·6	31·2	,, moderately worn.
,,	5.12.2.37	♀ (juv.)	70·0	44·0	34·0	18·4	14·0	24·6	19·8	45·2	24·2	30·2	,, not worn.

* Type.

DENTAL MEASUREMENTS OF *MARTES*.

Locality.	Number.	Sex.	Upper carnassial.	Upper molar.	Lower carnassial.
M. martes martes.					
England: Cockermouth, Cumberland	97. 1. 15. 1		8·8 × 6·2	4·8 – 6·6 × 9·2	—
Keswick	6. 2. 24. 1	♂	8·8 × 6·8	5·0 – 7·2 × 10·0	11·0 × 5·2
Ludford Park, Hereford	0. 2. 23. 1		8·8 × 6·4	4·8 – 6·0 × 9·0	—
Sweden	1291 U.S.N.M.	♂?	8·8 × 6·2	4·4 – 6·4 × 8·8	10·2 × 4·4
,,	1290 ,,		8·6 × 5·8	4·6 – 6·0 × 8·4	10·4 × 3·8
Denmark	1964 ,,	♀?	8·2 × 5·4	4·6 – 6·2 × 8·4	—
Germany: Southern Germany	1881		8·8 × 5·6	4·4 – 6·2 × 9·0	10·4 × 4·0
,,	1299*f*		8·4 × 5·2	4.2 – 7·0 × 9·0	—
M. martes latinorum.					
Sardinia	95. 4. 16. 1[8]	♂	8·8 × 5·8	4·4 – 6·2 × 8·8	—
Spain: San Cristobal, Minorca, Balearic Islands	0. 7. 1. 43	♀	8·2 × 5·4	4·6 – 6·0 × 8·2	—

M. foina foina.					
France: Manonville, Meurthe-et-Moselle .	95. 9. 5. 1	♀	9·0 × 5·2	4·6 – 5·2 × 7·8	9·8 × 3·6
Germany: Ingelheim, Rheinhessen . .	8. 11. 2. 17	♂	9·6 × 5·4	5·0 – 6·6 × 9·2	10·4 × 4·0
Nuremberg, Bavaria . . .	1850 U.S.N.M.	♀?	9·4 × 5·0	4·4 – 5·4 × 8·0	9·8 × 4·0
Southern Germany . . .	1299*a*	♀	8·6 × 5·4	4·6 – 6·0 × 7·8	9·4 × 3·8
,, . . .	1299*d*	♀	9·0 × 5·2	5·0 – 5·4 × 8·2	9·8 × 4·0
,, . . .	1299*c*		8·8 × 5·4	4·2 – 5·4 × 8·2	—
,, . . .	1299*e*		8·8 × 5·2	4·4 – 5·2 × 8·0	9·4 × 4·0
,, . . .	1299*b*	♂	9·2 × 6·0	4·2 – 5·6 × 8·2	10·0 × 4·6
,, . . .	1299*g*	♂	9·0 × 5·2	4·6 – 5·6 × 8·0	9·2 × 4·0
Switzerland: Thayngen, Schaffhausen .	115215	♂ juv.	9·6 × 5·8	4·4 – 6·2 × 8·6	10·2 × 4·0
Oberrich, St. Gallen . .	2. 8. 4. 21	♂	9·6 × 6·0	4·6 – 6·2 × 8·8	10·0 × 4·4
M. foina mediterranea.					
Spain: Sierra de Jerez	98. 3. 18. 1*	juv.	9·2 × 5·2	4·6 – 5·4 × 8·0	10·0 × 4·0
M. bunites.					
Crete	5. 12. 2. 18	♂	8·8 × 5·8	4·8 – 5·6 × 8·2	10·0 × 4·2
,, ...	5. 12. 2. 22*	♂	9·2 × 6·0	4·8 – 6·0 × 8·8	10·6 × 4·2
,, ...	5. 12. 2. 21		8·4 × 5·0	4·2 – 5·4 × 7·4	9·2 × 3·6
,, ...	5. 12. 2. 37	♀ juv.	8·2 × 5·4	4·0 – 5·0 × 7·8	9·2 × 3·6

* Type.

Greece: Mt. Vuno, Cephalonia, 1 (colour normal; size apparently rather small).

♀, juv.	Manonville, Meurthe-et-Moselle, France.	Lord Lilford (p).	95. 9. 5. 1–2.
♂.	Ingelheim, Rheinhessen, Germany.	C. Hilgert (c).	8. 11. 2. 17.
♂.	Ingelheim, Rheinhessen.	G. Barrett-Hamilton (p).	11. 1. 2. 102.
7 skulls.	South Germany.	Dr. A. Günther (c).	1299, a–g.
2 ♂ juv.	Schaffhausen, Switzerland. (*E. H. Zollikofer.*)	O. Thomas (p).	2. 8. 4. 22–23.
♂.	Oberrich, St. Gallen. (*E. H. Zollikofer.*)	O. Thomas (p).	2. 8. 4. 21.
♂.	Silos, Burgos, Spain.	Rev. Saturio Gonzalez (c).	8. 7. 7. 21.
1.	Rome, Italy.	E. Cavendish Taylor (p).	5. 5. 6. 7.
1.	Mt. Vuno, Cephalonia, Greece. (*C. Mottaz.*)	J. I. S. Whitaker (p).	8. 10. 1. 9.

Martes foina mediterranea Barrett-Hamilton.

1898. *Mustela mediterranea* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., 1, p. 442, June, 1898.

1910. *Mustela foina mediterranea* Trouessart, Faune Mamm. d'Europe, p. 73.

Type locality.—Sierra de Jerez, Cadiz, Spain.

Geographical distribution.—Southern Spain.

Characters.—Longer hairs of back tipped with a light yellowish brown, the general hue of upper parts lighter, yellower and less drab than in true *foina*.

Measurements.—For cranial and dental measurements see Tables, pp. 377, 379.

Specimens examined.—Two, the type, from the province of Cadiz, and a second specimen (mummy) from the Sierra Nevada.

Remarks.—If the two individuals of *Martes foina mediterranea* are not abnormal in colour the race is rather well characterized. I have seen only one skin of true *foina* that approaches them, a specimen from Rome.

1 juv.	Sierra de Jerez, Cadiz, Spain.	A Chapman (c & p).	98. 3. 18. 1. (*Type* of subspecies.)

Martes bunites Bate.

1899. *Mustela foina leucolachnæa* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., iv, p. 383 (Not of Blanford).

1906. *Mustela foina bunites* Bate, Proc. Zool. Soc. London, 1905, ii, p. 318, April 5, 1906.

1910. *Mustela foina bunites* Trouessart, Faune Mamm. d'Europe, p. 73.

Type locality.—Kontopalo, Kania, Crete.

Geographical distribution.—Crete.

Diagnosis.—In general like *Martes foina*, but size not so

large (condylobasal length of skull in adult male not reaching 80 mm.), rostral portion of skull not so broad, and pale throat-patch so much encroached on by brown of surrounding parts, that it is occasionally absent.

Colour.—The colour is lighter and more yellowish (less drab) than in *Martes foina foina*, as the long hairs continue a clear wood-brown to tips, producing a general effect more nearly a light isabella-colour than drab. The difference is, however, not very great. Tail and feet essentially as in *M. f. foina*, though not so dark. Throat-patch greatly reduced, absent in one of the seven skins,* and in its most extreme development represented by a mere horseshoe-shaped mark, one extremity of which lies in front of each fore leg, while the anterior portion broadens out to form an irregular patch covering entire throat immediately behind interramial region.

Skull and teeth.—The skull and teeth resemble those of *Martes foina* except for their uniformly smaller size and the relatively somewhat less breadth of the rostrum.

Measurements.—External measurements of type (young-adult male): head and body, 403; tail, 255; hind foot, 79; ear from meatus, 39. For cranial and dental measurements see Tables, pp. 377, 379.

Specimens examined.—Seven, all from Crete.

♂, 2.	Kanea, Crete.	Miss D. Bate (c).	5. 12. 2. 18–20.
1.	Katharo.	Miss D. Bate (c).	5. 12. 2. 21.
♂.	Kontopalo.	Miss D. Bate (c). (*Type* of species.)	5. 12. 2. 22.
skull.	Crete.	Miss D. Bate (c).	5. 12. 2. 37.
2.	Crete.	H. O. Jones, R.N. (c).	99. 6. 13. 2–3.

Genus **MUSTELA** Linnæus.

(Synonymy under sub-genera.)

Type species.—*Mustela erminea* Linnæus.

Geographical distribution.—Northern hemisphere from the Arctic coast south in the Old World to northern Africa and the Malay Archipelago, and in America to the Andes; in Europe east to Ireland.

Characters.—Skull in general resembling that of *Martes*, but rostrum so shortened that distance from orbit to gnathion is less than width of rostrum between anteorbital foramina; auditory bulla without meatal tube, its outline variable but never flask-shaped; paroccipital process small and flattened, closely applied to posterior margin of bulla; dental formula: $i\ \frac{3-3}{3-3}$, $c\ \frac{1-1}{1-1}$, $pm\ \frac{3-3}{3-3}$,

* A small tuft of white hair persists behind each angle of mouth, and another in front of each fore leg, the largest of these about 15 mm. in diameter.

$m\,\frac{1\,1}{2\,2} = 34$; upper carnassial as in *Martes*, its posterior cusp low but well developed, the height of its main cusp about half outer border of crown ; upper molar between pyriform and pandurate in outline, the constriction evident though not deep, the main axis of the crown nearly perpendicular to sagittal line ; lower carnassial without metaconid, the posterior heel crossed by a longitudinal trenchant ridge ; other teeth essentially as in *Martes ;* external form slender, the muzzle obtuse, the ears low and rounded, the legs short, the tail variable in length and in quality of hair, but never so bushy as in *Martes*.

Remarks.—The genus *Mustela*, the most widely distributed of the strictly terrestrial *Mustelinæ*, is also the richest in species. These fall into three main groups, extreme members of which might be regarded as generically distinct. The existence of species with intermediate characters makes it impossible to define these groups by anything more than their average differences.* They are therefore here treated as sub-genera. All three are represented in Europe.

KEY TO THE EUROPEAN FORMS OF *MUSTELA*.

Brain-case broad, the mastoid width decidedly greater than distance between basion and palation; auditory bullæ triangular in outline (Sub-genus *Putorius*, Polecats)..... *M. putorius*, p. 419.
Underfur usually buffy grey (Central Europe)..... *M. p. putorius*, p. 423.
Underfur usually yellowish (Southern Spain) ..... *M. p. aureolus*, p. 425.
Brain-case narrow, the mastoid width less than or about equal to distance between basion and palation; auditory bullæ not triangular in outline.
Rostrum flattened above; inner margins of auditory bullæ strongly divergent posteriorly; tail bushy; habits semi-aquatic (Sub-genus *Lutreola*, Minks)..... *M. lutreola*, p. 415.
Rostrum convex above; inner margins of auditory bullæ nearly parallel; tail not bushy; habits terrestrial (Sub-genus *Mustela*, Stoats and Weasels).
Tail with conspicuous black terminal area including more than pencil; skull with rostrum usually not so wide as interorbital region; condylobasal length of skull never less than 43·4 mm. in adult male, or than 35·4 mm. in adult female; hind foot usually more than 43 mm. in males and 34 mm. in females (Stoats).
Brown of sides noticeably encroaching on yellowish or whitish of underparts, the line of demarcation irregular; upper lip always brown ..... *M. hibernica*, p. 398.

* At least so far as *Lutreola* and true *Mustela* are concerned. *Putorius* appears to be sharply circumscribed, so that it might readily be regarded as a distinct genus (see remarks on p. 419).

Brown of sides not encroaching on yellowish or whitish of underparts, the line of demarcation straight; upper lip wholly or partly white..... *M. erminea*, p. 385.

Region extending from front of rostrum to and including postorbital processes relatively broad and short; size below the maximum for the European races; condylobasal length of skull in adult males, 43·4 to 48·6 mm., mandible in adult males, 23 to 26·4 mm. (Scandinavin Peninsula, except extreme south of Sweden)..... *M. e. erminea*, p. 387.

Region extending from front of rostrum to and including postorbital processes relatively narrow and long; size maximum for the European races; condylobasal length of skull in adult males, 47 to 52·5 mm., mandible in adult males, 25 to 30 mm.

Zygomatic arches broadly spreading (ratio of zygomatic breadth to condylobasal length about 59); posterior extension of palate unusually short and broad (Islands of Islay and Jura, Scotland) ..... *M. e. ricinæ*, p. 397.

Zygomatic arches moderately spreading (ratio of zygomatic breadth to condylobasal length about 54); posterior extension of palate not unusually short and broad.

White winter coat normally assumed; condylobasal length of skull in adult male seldom over 50 mm.; in adult female seldom over 45 mm.; upper carnassial not enlarged and thickened (Continental Europe from southern Sweden to the Alps and Pyrenees) *M. e. æstiva*, p. 389.

White winter coat normally not assumed; condylobasal length of skull in adult male often over 50 mm.; in adult female often over 45 mm.; upper carnassial enlarged and thickened (Great Britain)..... *M. e. stabilis*, p 390.

Tail without conspicuous black terminal area, though a tuft of black or blackish hairs may be present in pencil; skull with rostrum usually wider than interorbital region; condylobasal length of skull, except in specimens from the Mediterranean region, often less than 40 mm. in males, and 34 mm. in females; hind foot (except in *M. africana*) usually less than 41 mm. in males and 25 mm. in females (Weasels).

Size about as in the smaller stoats, condylobasal length of skull in adult male, 48 to 50 mm., mandible in adult male about 28 mm., its depth at front of carnassial, 4·5 to 5 mm.; tail nearly one-half as long as head and body (*africanus* group).

Brown of sides noticeably encroaching on yellowish or whitish of underparts, the line of demarcation irregular (Malta, Azores) ..... *M. africana*, 412.

Brown of sides not encroaching on yellowish or whitish of underparts, the line of demarcation straight (Crete)..... *M. galinthias*, p. 414.

Size less than in the stoats, condylobasal length of skull in adult male, 37 to 47 mm.; mandible in adult male not more than 24 mm., its depth at front of carnassial less than 4·5 mm. (true Weasels)..... *M. nivalis*, p 401.

Winter pelage often white; size small, hind foot of males, 29 to 34 mm. (Northern and central Europe) ..... *M. n. nivalis*, p. 402.

Winter pelage very rarely white; size medium or large, hind foot of males usually 32 to 41 mm. (Mediterranean region).

Skull of adult male not infrequently 44 to 46·6 mm. in condylobasal length; hind foot of adult male 34 to 41 mm.; colour rather dark (Central Mediterranean region)..... *M. n. boccamela*, p. 405.

Skull of adult male seldom if ever exceeding 44 mm. in condylobasal length; hind foot of adult male 30 to 37 mm.; colour rather light (Iberian Peninsula)..... *M. n. iberica*, p. 407.

Sub-genus **MUSTELA** Linnæus.

1758. *Mustela* Linnæus, Syst. Nat., I, 10th ed., p. 45 (Type by tautonymy *M. erminea* Linnæus).
1829. *Arctogale* Kaup, Entw.-Gesch. u. Natürl. Syst. Europ. Thierw., I, p. 30 (*erminea*).
1829. *Ictis* Kaup, Entw.-Gesch. u. Natürl. Syst. Europ. Thierw., I, p. 35 (*vulgaris* = *nivalis*). Not of Schinz, 1824–1828.
1841. *Gale* Wagner, Schreber's Säugthiere, Suppl., II, p. 234 (*vulgaris* = *nivalis*).
1857. *Fœtorius* Blasius, Säugethiere Deutschlands, p. 219 (part).
1865. *Neogale* Gray, Proc. Zool. Soc., London, p. 114 (*brasiliensis*, *aureoventris* and *xanthogenys*).
1871. *Mustelina*, Bogdanow, Труд. Общ. Естеств. Казанск. Универс. I, Mem. I, p. 167.
1899. *Eumustela* Acloque, Faune de France, Mammifères, p. 62 (*vulgaris* and *erminea*).
1911. *Mustela* Thomas, Proc. Zool. Soc. London, p. 138, April, 1911.

Type species.—*Mustela erminea* Linnæus.

Geographical distribution.—Northern hemisphere, south in the Old World to northern Africa, and in the New World to the Andes; in Europe west to Ireland.

Characters.—Form very slender; tail not bushy; fur not modified for aquatic life; skull without noticeably projecting mastoid processes; auditory bulla not triangular, the inner and outer borders nearly parallel; posterior border of pm^3 shearing

against anterior border of pm_3; other small premolars not capable of trenchant action.

Remarks.—The sub-genus *Mustela* is the most widely distributed group in the genus. It is also the richest in species and local races. About seventy of these are now recognized, eleven of which occur in Europe.

MUSTELA ERMINEA Linnæus.

(Synonymy under subspecies.)

Geographical distribution.— Europe from the Arctic coast to the Pyrenees and Alps, and from Great Britain eastward into Asia.

Diagnosis.—Skull with narrow brain-case and slightly projecting, scarcely angular mastoid region, the mastoid breadth less than distance from basion to palation; rostral width across canines usually less than interorbital width; auditory bullæ much longer than broad, nearly parallel sided, rounded posteriorly, truncate anteriorly; form very slender, the tail slender and not bushy; colour brown above, whitish below, the line of demarcation straight; a white winter pelage assumed in colder parts of range; tail always with black tip including more than terminal pencil; upper lip always at least partly white; ear usually with a whitish rim.

External characters.—General form long and slender, the legs short, the body cylindrical, the neck long and nearly as thick as body, tail considerably longer than outstretched hind leg. Ear short but appearing distinctly above fur of head, its outline evenly rounded, both outer and inner surface densely clothed with short hair; muzzle rather broad and short, the nostril pad sharply defined, entirely naked, separated from upper lip by a narrow hairy area. Palm and sole completely furred in winter, the tubercles bare in summer; on both palm and sole there is a trilobed, heart-shaped tubercular mass at base of median digits and a small round pad at base of inner digit; on palm there is an additional posterior rounded pad near wrist. Fur dense and soft, the longest hairs on back about 10 mm. in winter, less in summer; tail rather closely haired, the pencil full, usually wider than basal portion of tail, its longest hairs about half as long as vertebræ; fur turning white in winter except in warmer parts of range. Mammæ: $i\ 4-4 = 8$.

Colour.—Upper parts and outer surface of legs yellowish brown, usually a little darker along middle of back and on head, the underfur and bases of the longer hairs much paler; underparts, inner surface of legs and upper surface of feet whitish or yellowish in strong contrast, the line of demarcation between

the two colours straight and definite, extending along middle of sides of body and neck and passing a little below ear and eye to lower edge of muzzle pad, normally leaving upper lip white; ear brown, the rim whitish; no dark spot behind angle of mouth; tail with terminal fifth and entire pencil black, elsewhere concolor with back except for an ill-defined yellowish or whitish median area which occasionally extends along under surface from base toward or to black tip. In white winter pelage the entire animal is white or whitish (often tinged with yellow), with the

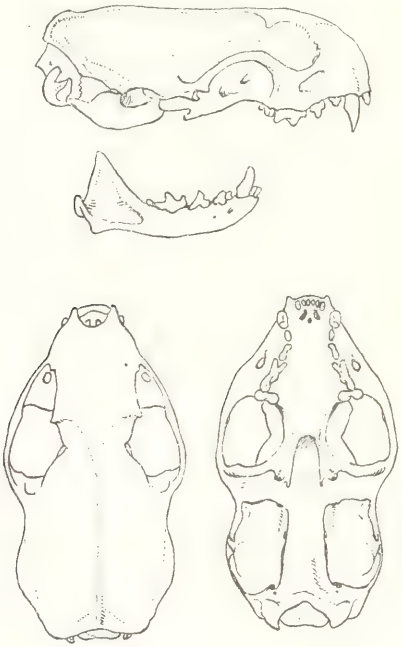

FIG. 81.
Mustela erminea. Nat. size.

exception of the black area of the tail, which remains as in the dark coat.

Skull.—In general appearance the skull resembles that of *Mustela putorius* (p. 421). This is especially true of the dorsal profile, the form of the palate, rostrum and interorbital region, in all of which the differences between the two animals are very slight. Breadth of rostrum over canines rarely equal to least interorbital width. Position of anteorbital foramen as in *M. putorius*, but orifice relatively larger, the width of plate separating it from

orbit distinctly less than that of foramen. Postorbital process short, not evidently directed backward. Zygomata more widely spreading than in *M. putorius*, strongly and evenly bowed when viewed from the side, the orbital process barely indicated and posterior widening absent. Owing to shortness of postorbital process and virtual absence of orbital process of zygoma, the orbit is less margined with bone than in *M. putorius*. Brain-case longer and narrower than in *Mustela putorius*, the outline when viewed from above elongate ovate not distorted by the presence of conspicuously projecting mastoid regions; sagittal crest slight, even in old individuals; lambdoid crest moderately developed, scarcely overhanging, the condyles usually visible from above. Floor of brain-case nearly flat, though with the usual median ridge and lateral and posterior depressions present. Auditory bullæ moderately inflated throughout, about three-quarters as wide as long, nearly parallel sided, squarely truncate in front, rounded behind, the meatus not tubular; anterior extremity of bulla not in contact with hamular, and separated from foramen ovale by a broad nearly flat area, the length of which is about one-half distance between foramina; inner extremity of glenoid surface marked off by a wide, shallow notch. Postorbital region abruptly constricted, short, without indication of the neck-like elongation which forms so conspicuous a feature of the skull of *M. putorius*. Mandible with lower border slightly convex, its posterior fourth somewhat elevated above general outline; angular process small but better developed than in *M. putorius*.

Teeth.—Except for their smaller size the teeth are essentially like those of *Mustela putorius*. Enamel of lower canine not rugose. Second upper premolar and third lower premolar more compressed than in the larger animal, and with base of cusp shorter, so that there is a slight but evident concavity or flattening at both anterior and posterior base. Upper carnassial with inner lobe projecting more forward than in *M. putorius*, so that its anterior border extends nearly to level of that of outer margin of tooth. Upper molar and posterior lower molar as in *Mustela putorius*, but m^1 with metacone more reduced, and m_2 with crown area distinctly smaller than that of heel of carnassial.

MUSTELA ERMINEA ERMINEA Linnæus.

1758. [*Mustela*] *erminea* Linnæus, Syst. Nat., I, 10th ed., p. 46 (Sweden).

1792. *M*[*ustela*] *erminea hyberna* Kerr, Anim. Kingd., p. 181 (name applied to the northern true ermine).

1816. *M*[*ustela*] *herminea* Oken, Lehrb. d. Naturgesch., III, pt. 2, p. 1026 (Renaming of *erminea*).

1827. [*Mustela erminea*] *β maculata* Billberg, Synopsis Faunæ Scandinaviæ, p. 8 (Scandinavia).

1857. *Fœtorius erminea* Blasius, Säugethiere Deutschlands, p. 228 (part).

1877. *Putorius erminea* Coues, Fur-bearing Animals, p. 109 (part).
1910. *Putorius* (*Ictis*) *ermineus* Trouessart, Faune Mamm. d'Europe, p. 78 (part).

Type locality.—Upsala, Sweden.

Geographical distribution.—Scandinavian Peninsula, except extreme south of Sweden; eastern limits of range unknown.

Characters.—Region extending from front of rostrum to and including postorbital processes relatively broad and short; size below maximum for the European races: condylobasal length of skull in adult male, 43·4 to 48·6 mm.; mandible in adult male, 23 to 26·4 mm.; basal portion of tail (in summer pelage) usually lighter below than above.

Measurements.—Hind foot in each of two males from the vicinity of Christiania, Norway, 43 mm.; in a female from the same region, 35 mm. Male and female from Nordre Fron, Lower Gudbrandsdal: hind foot, 43 and 34 mm. Two males from Lappmark, Sweden: hind foot, 44 and 46 mm. Adult female from Upsala, Sweden: hind foot, 36 mm. Adult male from Stockholm, Sweden: hind foot, 44·6. For cranial measurements see Table, p. 392.*

Specimens examined.—Twenty-five, from the following localities:—
Sweden: Karesuando, Lappmark, 1 (U.S.N.M.); Wilhelmina, Lappmark, 1 (U.S.N.M.); Jemtland, 1 (U.S.N.M.); Upsala, 1 (U.S.N.M.); Stockholm, 2 (U.S.N.M. and Stockholm).
Norway: Aker, near Christiania, 2; Brekkebygden, Trondhjem, 1; Nordre Fron, lower Gudbrandsdal, 2; Marestuen, Fillefjeld, Bergen, 1, Egersund, Stavanger, 13.

Remarks.—The Scandinavian form of *Mustela erminea* is distinguishable from the other European races by its slightly smaller size and by the broader rostro-frontal region of the skull, characters which appear to be fairly constant. Of the other races it perhaps most closely resembles *M. erminea ricinæ* from the islands of Islay and Jura, west Scotland. The white winter coat is normally assumed throughout the range of this form.

♂, ♂ juv.	Aker, Christiania, Norway.	Christiania Museum (E).	93. 3. 1. 2, 4.
♀.	Brekkebygden, Trondhjem.	Christiania Museum (E).	93. 3. 1. 3.
♂, ♀.	Nordre Fron, Gudbrandsdal.	Christiania Museum (E).	93. 3. 1. 5–6.
♀.	Marestuen, Fillefjeld, 2,500 ft.	E. R. Alston (P).	79. 9. 25. 21.
13 skulls.	Egersund, Stavanger.	K. H. Schaanning (C).	11. 6. 3. 22–34

* In eight skulls of males from Egersund, Stavanger, Norway (all sutures closed, teeth slightly or not worn), received after the Tables were in type, the averages and extremes are as follows: condylobasal length, 44·2 (43·4–45·2); zygomatic breadth, 24·2 (23·6–25·4); mandible, 23·8 (23·0–24·8). Two females from the same locality: condylobasal length, 35·4 and 38·0; zygomatic breadth, 18·6 and 20·0; mandible, 18·2 and 19·2.

Mustela erminea æstiva Kerr.

1792. *M[ustela] erminea æstiva* Kerr, Anim. Kingd., p. 181 (Germany; based on Schreber's pl. 137A).

1820. *Mustela erminea major* Nilsson, Skand. Fauna, I, p. 34 (Carlskrone, Blekinge, Sweden).

1857. *Fœtorius erminea* Blasius, Säugethiere Deutschlands, p. 228 (part).

1910. *Putorius (Ictis) ermineus* Trouessart, Faune Mamm. d'Europe, p. 78 (part).

Type locality.—Germany.

Geographical distribution.—Continental Europe from southern Sweden to the Alps and Pyrenees.

Characters.—Region extending from front of rostrum to and including postorbital processes relatively narrow and long; size larger than in *M. erminea erminea;* condylobasal length of skull in adult male, 47 to 51 mm.; mandible in adult male, 25 to 29 mm.

Measurements.—Two young adult males from Pic du Midi, Hautes-Pyrénées, France: head and body, 235 and 240; tail, 82 and 85; hind foot, 44 and 44; ear from meatus, 17 and 17. Three males from Strass, near Burgheim, Bavaria: head and body, 265, 270 and 280; tail, 90, 100 and 102; hind foot, 44, 47 and 48. Two females from the same locality: head and body, 240 and 240; tail, 80 and 90; hind foot, 38 and 40. Average and extremes of eight adult males from the vicinity of St. Gallen, Switzerland: head and body, 271 (251–292); tail, 104 (94–111); hind foot, 47 (45–50). Three adult females from the same region: head and body, 226 (218–242); tail, 89 (85–98); hind foot, 38·8 (37·6–41).

Specimens examined.—Seventy-nine, from the following localities:—

Denmark: No exact locality, 2 (skulls, Copenhagen); Amager, 1 (skull, Copenhagen); Faaborg, Fyn, 4 (skulls, Copenhagen); Vestervig, Jutland, 1 (skull, Copenhagen).

Holland: Texel Island, 1.

France: Pic du Midi, Hautes-Pyrénées, 2; Manonville, Meurthe-et-Moselle, 1.

Germany: Neustadt, Wied, 1; Ingelheim, Rheinhessen, 8; near Magdeburg, 2; Bleiche, Saxony, 5; Moritzburg, Saxony, 1 (U.S.N.M.); Rudolstadt, Thüringen, 3; Marxheim, Bavaria, 4; Strass, near Burgheim, Bavaria, 5; no exact locality, south Germany, 6 (skulls).

Austria-Hungary: Csallóköz-Somorja, Pressburg, Hungary, 1.

Switzerland: Frête-de-Sailles, Vaud, 1 (U.S.N.M.); Frutigen, Bern, 1 (U.S.N.M.); Rorbas, Bern, 1 (U.S.N.M.); Zürich, 1 (U.S.N.M.); St. Gallen, 4 (U.S.N.M.); Degersheim, St. Gallen, 5 (U.S.N.M.); Rorschach, St. Gallen, 1 (U.S.N.M.); Züberwangen, St. Gallen, 5; Untervatz, Grisons, 3 (B.M. and U.S.N.M.); Prättigau, Grisons, 1 (U.S.N.M.); Vals, Grisons, 1 (U.S.N.M.); Obersaxen, Grisons, 1 (U.S.N.M.); Pontresina, Grisons, 1 (U.S.N.M.); Scanfs, Grisons, 1 (U.S.N.M.); Poschiavo, Grisons, 1 (U.S.N.M.); Ems, Grisons, 2; Osogna, Ticino, 1 (U.S.N.M.).

Remarks.—The ermine of central Europe differs from that of Scandinavia in slightly greater size and in the narrower rostrofrontal region of skull. The white winter pelage is normally assumed throughout the range of the form.

As shown by both external and cranial measurements the two specimens from the Pic du Midi are unusually small. It is possible that they represent a peculiar Pyrenean race.

♂.	Texel Id., Holland.	J. L. Bonhote (C & P).	8. 10. 26. 1.
2 ♂.	Pic du Midi, Hautes Pyrénées, France. (*A. Robert.*)	O. Thomas (P).	8. 9. 1. 52–53.
♂.	Manonville, Meurthe-et-Moselle. (*Lomont.*)	Lord Lilford (P).	11. 1. 1. 139
♀.	Untervatz, Grisons, Switzerland. (*E. H. Zollikofer.*)	O. Thomas (P).	4. 4. 5. 33.
♂, ♀.	Ems, Grisons. (*E. H. Zollikofer.*)	O. Thomas (P).	2. 8. 4. 25–26.
♂.	Neustadt, Wied, Germany. (*Schneider.*)	Lord Lilford (P).	11. 1. 1. 138.
5 ♂, 3 ♀.	Ingelheim, Rheinhessen.	C. Hilgert (C).	8. 11. 2. 22–28.
2.	Magdeburg, Prussia.	Dr. W. Wolterstorff (P).	0. 2. 8. 6–7.
4 ♂.	Bleiche, Saxony. (*H. Tornitz.*)	Lord Lilford (P).	11. 1. 1. 140–143.
♂.	Marxheim, Bavaria. (*Wolterstorff.*)	Lord Lilford (P).	11. 1. 1. 145.
♂.	Strass, Burgheim. (*Körbitz.*)	Lord Lilford (P).	11. 1. 1. 144.
6.	South Germany.	Dr. A. Günther (C).	59. 9. 6. 64–69.
1.	Csallóköz-Somorja, Pressburg, Austria-Hungary.	Budapest Museum (E).	94. 3. 1. 1.

Mustela erminea stabilis Barrett-Hamilton.

1904. *Putorius ermineus stabilis* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., XIII, p. 394, May, 1904.

1910. *Putorius* (*Ictis*) *ermineus stabilis* Trouessart, Faune Mamm. d'Europe, p. 79.

Type locality.—Blandford, Dorset, England.

Geographical distribution.—Mainland of Great Britain.

Diagnosis.—Size slightly greater than in *M. erminea æstiva*: condylobasal length of skull in adult male, 49 to 52·4 mm.; mandible in adult male, 27 to 30 mm.; teeth usually larger than in the continental races, a peculiarity especially noticeable in the upper carnassial; colour averaging slightly darker above and less strongly yellow below than in the continental forms (though in extreme instances the underparts are between buff and straw-yellow, quite as in the brightest continental specimens); tail usually without distinct lighter area below.

Measurements.—External measurements of type (adult female): head and body, 244; tail, 105; hind foot, 43; ear from meatus, 22. Another adult female from the type locality: head and body, 245; tail, 102; hind foot, 43; ear from meatus, 21. Two adult males from Banstead, Surrey: head and body, 270 and 278; tail, 119 and 119; hind foot, 47 and 49. Two adult males from Wales: head and body, 274 and 280; tail, 120 and

120; hind foot, 48 and 48·6. Adult male from Farr, Daviot, Inverness: head and body, 254; tail, 110; hind foot, 48·5.

Specimens examined.—Seventy-four, from the following localities:—

Scotland: Thurso, Caithness, 1; Sutherlandshire, 1; Cromarty, 4; Annadale, Skye, 2; Farr, Daviot, Inverness, 1 (Wilson); Stockbriggs, Lanark, 9; Wyseley, Dumfries, 2; Ecclefechan, Dumfries, 1 (U.S.N.M.).

Wales: North Wales, no exact locality, 1; Nannerch, Flintshire, 2; Vaynol, Carnarvonshire, 2; Usk, Monmouthshire, 2; St. Brides, Pembrokeshire, 1; St. Fagan's, Cardiff.

England: Riding-Mill-on-Tyne, Northumberland, 1; Westmoreland, 1; Doncaster, Yorkshire, 2; Leeds, Yorkshire, 1 (U.S.N.M.); Gainsborough, Lincolnshire, 1; Derbyshire, 1; Sandringham, Norfolk, 3; Lowestoft, Suffolk, 1; Bury St. Edmunds, Suffolk, 1; Friswell, Cambridgeshire, 8; Rugby, Warwickshire, 1; Graftonbury, Hereford, 3; Tring, Hertford, 2; Felden, Hertfordshire, 1; Banstead, Surrey, 2; Laseley Park, Guildford, Surrey, 1; Buckland, Somerset, 2; Blandford, Dorset, 3; Eversley, Hampshire, 1; Whitechurch, Hampshire, 1; Selborne, Hampshire, 1; Staplehurst, Kent, 1; Horsham, Sussex, 2; Mayfield, Sussex, 3.

Remarks.—In the British stoat the change to the white winter coat does not take place so regularly and completely as in the continental forms. This is particularly true in central and southern England. Apart from this character, of problematical value, the animal is distinguishable by its heavy teeth. A few small though apparently well developed skulls from the north of Scotland indicate the possible existence there of a local form somewhat resembling true *erminea*.

♀.	Thurso, Caithness, Scotland (*Mrs. J. Edis*).	W. R. Sherrin (P).	9. 1. 9. 1.
3 ♀.	Cromarty.	W. R. Ogilvie-Grant (C & P).	11. 1. 3. 175–177.
♂, ♀.	Annadale, Skye.	Dr. Hastings (C & P).	11. 1. 3. 395–396
♂.	Sutherlandshire.	W. Paterson (C & P).	8. 11. 26. 1.
3 ♂, st.	Stockbriggs, Lanarkshire.	E. R. Alston (C & P).	79. 9. 25. 16, 18, 20.
3 ♂, ♀.	Stockbriggs, Lanarkshire.	E. R. Alston (C & P).	79. 9. 25. 14, 15, 17, 19.
♀.	Stockbriggs, Lanarkshire.	E. R. Alston (C & P).	79. 9. 25. 84.
♂, ♀.	Nannerch, Flintshire, Wales.	A. Richardson (C & P).	11. 1. 3. 192–193.
2 ♀.	Vaynol, Carnarvonshire.	J. E. Harting (P).	11. 1. 3. 194–195.
2 ♂.	Usk, Monmouthshire.	J. S. Phillips (C & P).	87. 8. 6. 1–2.
	St. Brides, Pembrokeshire.	Hon. C. Edwardes (C & P).	90. 12. 5. 1.
1.	St. Fagans, Cardiff.	J. Cording (C).	90. 6. 19. 1.
st.	Derbyshire, England.	Index Museum.	94. 4. 8. 1.
st.	Sandringham, Norfolk.	H.M. King Edward VII. (P).	96. 4. 13. 1.
2 st.	Sandringham, Norfolk.	H.M. King Edward VII. (P).	96. 11. 24. 1–2.
♀ st.	Lowestoft, Suffolk.	F. S. Worthington (C & P).	98. 2. 15. 1.
st.	Bury St. Edmunds, Suffolk.	T. Harcourt-Powell (C & P).	87. 2. 28. 1.
3 ♂, 4 ♀.	Friswell, Cambridgeshire.	W. Farren (C).	4. 5. 3. 1–8.
♂.	Rugby, Warwickshire.	E. E. Austen (C & P).	11. 1. 3. 181.

CRANIAL MEASUREMENTS OF *MUSTELA ERMINEA*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital breadth.	Breadth of rostrum over canines.	Mastoid breadth.	Occipital depth.	Palatal depth behind tooth-rows.	Rostral depth behind canines.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
M. erminea erminea.														
Sweden: Jemtland . . .	Stockholm	♂	48·6	26·2	12·2	11·4	22·8	12·8	11·8	7·6	26·2	13·2	15·2	Teeth moderately worn.
,, . . .	1042	♂	48·0	25·2	12·4	11·0	23·0	12·2	12·8	7·2	26·4	13·0	15·6	,, slightly worn.
,, . . .	1043	♂	46·6	27·6	12·0	10·2	22·4	12·4	12·0	7·8	--	12·2	—	,, ,,
Stockholm . . .	37421	♂	47·2		12·6	11·0	23·4	12·4	13·2	8·0	26·2	12·8	15·4	,, ,,
. . .	4365 Merriam	♂	44·2	28±	11·6	10·2	22·2	12·0	12·0	7·2	24·0	12·2	14·0	,, ,,
Karesuando, Lappmark	6548 Merriam	♂	47·8	26·6	12·2	11·6	22·0	12·8	11·8	7·4	25·6	12·8	15·2	,, not worn.
Wilhelmina ,,	6549 Merriam	♂	46±	26·2	12·4	11·0	22·4	12·6	11·8	7·2	24·8	12·2	14·6	,, ,,
Norway: near Christiania .	93. 3. 1. 2	♂	46·4	26·4	12·0	10·8	23·0	12·6	12 0	7·0	25·4	12·4	15·2	,, slightly worn.
,, .	93. 3. 1. 4	♂	44·2	25·4	11·2	10·6	21·4	11·0	12·0	6·6	23·8	12·2	14·0	,, ,,
Gudbrandsdal . .	93. 3. 1. 6	♀	38·8	21·2	9·0	8·8	18·8	-	9·6	5·8	19·0	10·0	12·0	,, not worn.
M. erminea æstiva.														
Denmark: Faaborg, Fyn . .	1077 Copenhagen	♂ juv.	48·4	26·4	—	13·0	22·0	—	12·4	—	26·4	12·6	15·0	,, ,,
,, ,, . .	732 Copenhagen	♂	51·0	28·0	—	13·4	25·0	—	13·6	--	29·0	13 6	16·8	,, much worn.
,, ,, . .	1031 Copenhagen	♂	51·0	30·0	—	14·0	25·2	—	13·4	—	28·6	13·6	16·4	

Denmark:	no exact locality .	653 Copenhagen	♀	43·6	23·0	—	11·0	21·0	—	11·4	—	23·4	11·4	13·6		
	„ „ .	655 Copenhagen	♀	44·0	23·8	—	12·2	22·8	—	12·0	—	23·2	11·4	14·0		
	Amager . . .	654 Copenhagen	♀	45·0	24·0	—	11·8	21·8	—	11·4	—	24·0	11·4	14·0		
	Faaborg, Fyn . .	1076 Copenhagen	♀	44·6	23·8	—	11·4	21·0	—	11·0	—	24·2	11·8	14·0		
	Vestervig, Jutland .	—	♀	45·0	22·0	—	11·2	20·4	—	11·0	—	24·2	11·8	14·2		
France:	Manonville, Meurthe-et-Moselle . .	11. 1. 1. 139	♂	49·0	27·8	12·0	12·0	23·0	12·2	13·0	7·8	27·0	13·0	15·4	Teeth slightly worn.	
	Pic du Midi, Hautes-Pyrénées . .	8. 9. 1. 52	♂	46·0	24·8	10·8	10·6	22·0	11·8	12·0	6·6	25·0	12·2	14·8	„	„
	„ „ .	8. 9. 1. 53	♂	45·4	24·2	11·2	10·2	21·0	—	11·4	6·8	25·0	12·4	15·0	„	not worn.
Germany:	Magdeburg . .	0. 2. 8. 6	♂	48·4	—	11·0	11·0	23·4	13·0	12·8	7·2	27·0	13·2	15·0	„	„
	Bleiche, Saxony .	11. 1. 1. 142	♂	48·6	—	12·0	11·4	23·0	12·4	—	7·4	27·0	13·4	14·8	„	slightly worn.
	„ „ .	11. 1. 1. 141	♂	49·0	27·4	12·0	11·2	24·0	13·0	13·6	8·4	26·8	13·2	16·2	„	moderately worn.
	„ „ .	11. 1. 1. 143	♂	48·4	27·4	12·2	11·0	23·2	13·0	13·4	7·4	27·2	13·4	16·0	„	slightly worn.
	„ „ .	152659	♂	50·2	—	12·0	11·4	24·0	14·0	13·0	7·8	27·2	13·8	16·8	„	„
	Strass, near Burgheim, Bavaria .	152661	♂	47·6	27·0	11·6	10·8	24·0	12·2	13·0	7·4	25·4	13·0	15·0	„	„
	„ „	11. 1. 1. 144	♂	47·0	28·8	12·8	12·2	24·0	13·2	13·0	7·8	27·2	13·0	16·0	„	moderately worn.
	Rudolstadt . .	152658	♂	47·8	27±	11·8	11·0	22·2	12·0	12·8	7·4	26·0	12·4	15·0	„	„
	Neustadt. . .	11. 1. 1. 138	♂	48+	—	11·8	11·4	22·6	12·8	13·4	7·0	27·0	13·2	15·4	„	not worn.
	Marxheim . .	11. 1. 1. 145	♂ juv.	47·0	—	12·4	11·0	22·4	12·8	12·6	7·2	25·4	12·4	14·2	„	„
	„ . . .	152655	♂ juv.	47·8	27·0	11·8	11·6	22·4	13·2	13·0	7·4	26·8	12·8	15·4	„	„
	„ . . .	152654	♂	50·0	—	11·8	11·4	23·0	12·8	13·2	7·6	27·4	13·0	16·0	„	„
	Ingelheim, Rheinhessen . . .	8. 11. 2. 22	♂	51·2	30·2	13·0	12·2	25·4	13·2	13·4	8·0	29·0	13·6	16·6	„	moderately worn.
	Magdeburg . .	0. 2. 8. 7	♀	—	—	10·6	10·2	—	—	11·4	7·0	23·4	11·4	14·0	„	not worn.
	Strass, near Burgheim, Bavaria .	—	♀	43·6	—	9·4	7·0	20±	10·4	11·0	6·2	23·0	11·8	13·4	„	slightly worn.

CRANIAL MEASUREMENTS OF *MUSTELA ERMINEA*—*continued*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital breadth.	Breadth of rostrum over canines.	Mastoid breadth.	Occipital depth.	Palatal depth behind tooth-rows.	Rostral depth behind canines.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
M. erminea æstiva (*continued*).														
Germany: Strass, near Burgheim, Bavaria	152660	♀	43·4	—	10·2	9·2	20·4	11·4	10·4	6·6	23·0	11·0	13·6	Teeth slightly worn.
Rudolstadt, Bavaria.	152656	♀	42·4	22±	8·6	8·4	18·0	10·8	10·0	5·8	23·0	11·0	13·0	,, ,,
Marxheim . .	—	♀	42·6	—	10·6	9·0	19·8	11·4	11·0	6·2	23·0	11·0	13·0	,, not worn.
Bleiche, Saxony .	—	♀	—	—	10·0	10·0	—	—	11·0	7·0	23·6	11·8	14·0	,, moderately worn.
Ingelheim, Rheinhessen . . .	8. 11. 2. 27	♀	41·6	23·4	10·0	9·0	20·6	11·2	11·2	6·2	22·8	11·0	13·2	,, slightly worn.
Switzerland: Geneva . .	2773 Mottaz	♂	47·4	26·8	—	10·0	22·4	12·4	—	7·6	26·2	12·6	15·0	,, ,,
Chesières, Vaud .	2151 ,,	♂	48·0	26·0	11·6	10·4	23·0	13·0	11·8	7·4	26·2	12·8	15·4	,, not worn.
Zürich . .	123635	♂	47·6	26·6	11·0	9·4	22·0	13·0	12·2	7·0	26·0	12·6	15·0	,, ,,
St. Gallen . .	145153	♂	48·4	26·8	12·2	11·0	23·2	12·8	13·4	7·8	27·6	12·8	15·6	,, moderately worn.
,, . .	121246	♂	49·0	27·0	11·4	10·2	22·6	12·0	12·8	8·0	27·0	13·0	15·6	,, slightly worn.
Züberwangen, St. Gallen . .	123631	♂	48·0	26·2	11·0	10·6	22·2	13·2	12·2	6·8	27·0	12·8	15·4	,, ,,
Weiern, St. Gallen	123630	♂	50·4	28·6	12·0	10·8	24·0	12·4	13·0	7·6	27·4	13·0	15·6	,, moderately worn.
,, ,,	123632	♂	48·4	26·0	10·8	10·6	22·0	12·0	12·2	6·8	26·0	13·2	15·6	,, not worn.
near Geneva .	1227 Mottaz	♀	45·0	23·2	10·8	9·0	21·0	11·0	11·4	7·0	23·4	11·8	14·0	,, moderately worn.
Züberwangen, St. Gallen . .	123633	♀	44·6	24·2	11·4	10·0	—	12·0	11·4	7·0	24·2	12·0	14·2	,, slightly worn.
Untervatz, Grisons	4. 4. 5. 33	♀	42·4	22·6	9·6	9·2	20·8	10·8	11·0	6·4	22·4	10·8	13·4	,, not worn.
,, ,,	123644	♀	41·8	22·8	10·0	9·0	19·4	11·4	11·0	6·2	21·4	10·8	13·2	,, moderately worn.
,, ,,	2. 8. 4. 25	♀	45·0	24·2	11·0	10·2	22·2	10·8	12·0	6·6	24·6	11·8	14·8	,, slightly worn.
Vals ,,	123641	♀	42·0	21·4	9·8	8·8	19·8	10·8	11·2	6·0	22·2	11·4	13·2	,, not worn.

M. erminea stabilis.

Scotland: Farr, Inverness-shire	Wilson 13	♂	49·8	—	11·6	11·4	22·6	13·2	12·4	8·2	27·2	14·0	16·2	Teeth	moderately worn.
Annadale, Skye	11. 1. 3. 395	♂	—	—	12·8	11·4	—	—	12·6	7·4	25·4	12·0	15·0	,,	slightly worn.
Ecclefechan, Dumfriesshire	152666	♂	48·8	—	12·2	10·8	—	—	12·8	7·2	27·6	12·8	15·2	,,	,,
Wales: Nannerch	11. 1. 3. 192	♂	50·0	28·4	13·8	12·4	—	13·0	15·0	7·4	29·0	13·4	16·4	,,	not worn.
North Wales	152662	♂	49·6	—	12·2	12·2	—	—	13·4	8·0	27·4	13·2	15·8	,,	moderately worn.
St. Brides	90. 12. 5. 1	♂ juv.	49·8	27·0	11·6	11·4	22·4	13·8	12·8	7·0	—	13·6	—	,,	not worn.
England: Sandringham, Norfolk	94. 4. 13. 1	♂	49·6	28·0	12·0	11·2	24±	—	13·4	8·0	27·0	13·0	16·2	,,	moderately worn.
Rugby	11. 1. 3. 181	♂	—	28·6	—	12·2	23·6	13·8	14±	7·6	27·0	12·8	15·4	,,	not worn.
Mayfield, Sussex	11. 1. 3. 186	♂	51·6	28·8	12·8	12·2	25·0	—	14·0	7·4	28·6	13·6	16·6	,,	,,
Buckland Denham, Somerset	11. 1. 3. 190	♂	52·0	29·0	12·2	11·8	24·0	13·4	13·4	8·0	29·0	14·0	17·2	,,	slightly worn.
Milford, Surrey	143680	♂	49·2	28·0	12·0	11·2	23·2	13·0	12·8	8·4	28·0	13·2	16·2	,,	,,
Felden, Hertfordshire	11. 1. 3. 184	♂	52·2	30·0	13·4	12·2	24·8	13·4	13·4	8·2	30·0	14·2	17·0	,,	much worn.
Selborne, Hampshire.	2. 11. 29. 1	♂	52·4	30·0	14·2	13·2	25·0	13·4	14·0	8·8	29·8	14·0	17·0	,,	,,
Scotland: Thurso	9. 1. 9. 1.	♀	43·2	23·0	10·8	8·8	19·8	11·2	11·0	6·4	22·8	11·2	13·2	,,	not worn.
Cromarty	11. 1. 3. 177	♀	43·8	23·4	10·6	10·0	20·0	11·2	11·4	6·6	23·6	12·0	14·4	,,	,,
,,	11. 1. 3. 175	♀	43·0	23·6	10·4	9·8	19·0	11·4	11·2	6·2	22·6	11·4	13·6	,,	,,
,,	—	♀	43·2	23·6	10·4	9·8	20·0	12·0	11·8	6·2	23·0	11·2	13·4	,,	slightly worn.
Annadale, Skye	11. 1. 3. 396	♀	42·0	22·4	10·2	9·4	20·2	12·0	11·0	—	22·4	11·2	13·4	,,	,,
Stockbriggs, Lanarkshire	79. 9. 25. 84	♀	46·0	25·8	11·8	10·4	22·6	12·6	11·8	6·6	—	11·8	—	,,	,,
Wales: Vaynol, Carnarvonshire	11. 1. 3. 194	♀	45·8	25·2	11·0	10·0	22·0	12·0	11·8	7·2	24·4	12·0	14·4	,,	,,
Nannerch, Flintshire	11. 1. 3. 193	♀	45·8	—	11·0	10·6	—	12·0	11·6	7·4	25·4	11·8	15·0	,,	not worn.
England: Barrow, Cumberland.	113262	♀	43·2	23·6±	10·8	8·6	20·8	14·2	11·4	7·0	23·2	10·8	13·6	,,	slightly worn.
Graftonbury, Hereford	11. 1. 3. 179	♀	44·6	22·6±	10·6	9·8	20±	11·0	11·6	7·2	24·0	11·6	14·0	,,	not worn.
,, ,,	11. 1. 3. 101	♀	45±	24·0	10·4	10·0	21·2	—	11·2	6·4	24·2	11·6	14·2	,,	,,
Mayfield, Sussex	11. 1. 3. 187	♀	47·0	25·0	10·6	10·0	21·0	11·8	12·4	6·8	25·6	12·0	15·4	,,	slightly worn.
Blandford, Dorset	11. 1. 3. 189	♀	47±	—	10·8	10·2	—	—	12·6	7·6	26·0	12·2	15·0	,,	not worn.
,, ,,	98. 5. 13. 2*	♀	48·0	27·0	11·4	10·6	22·8	12·2	12·0	7·8	26·0	13·0	16·0	,,	slightly worn.
,, ,,	11. 1. 3. 188	♀	47·2	27·0	11·2	10·6	22·4	13·0	12·2	7·2	25·4	12·6	15·0	,,	,,

* Type.

CRANIAL MEASUREMENTS OF *MUSTELA ERMINEA*—*continued*.

Locality.	Number.	Sex.	Greatest length of skull.	Zygomatic breadth.	Interorbital breadth.	Breadth of rostrum over canines.	Mastoid breadth.	Occipital depth.	Palato-basal depth behind last molar.	Length of upper carnassial and molar.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
M. erminea stabilis (*continued*).														
England: Whitchurch, Hampshire	11. 1. 3. 185	♀	47·2	24·2	—	10·6	21·6	11·6	—	7·6	25·0	12·2	14·8	Teeth slightly worn.
Staplehurst, Kent		♀	44·4	25·4	11·2	10·2	21·0	11·2	12·0	7·2	24·0	11·4	14·0	,, not worn.
M. erminea ricinæ.														
Scotland, Islay	7. 10. 19. 1*	♂	47·0	29·2	12·4	11·2	23·2	13·0	13·2	7·8	26·8	12·0	15·0	,, slightly worn.
,,	15267	♂	48·0	28·8	12·2	11·8	24·6	13·0	14·0	7·4	27·0	12·6	15·4	,, not worn.
,,	11. 1. 3. 196	♂	49·2	29·6	13·2	12·4	24·6	13·0	13·6	8·2	28·0	12·8	15·6	,, slightly worn.
,,	350 Kintour	♂	50·0	30·6	—	11·2	24·6	13·0	13·2	—	28·0	13·4	16·0	,, ,,
,,	392 ,,	♂	49·4	31·2	—	11·2	25·0	13·0	13·2	—	28·8	13·4	15·4	,, ,,
,,	400 ,,	♂	48·4	28·4	—	10·8	24·0	13·0	13·4	—	27·0	13·2	15·4	,, not worn.
,,	349 ,,	♀	44·0	24·8	—	9·2	21·0	11·4	12·0	—	24·0	11·4	14·0	,, slightly worn.
,,	377 ,,	♀	46·0	26·4	—	10·0	22·6	12·0	12·0	—	25·6	12·0	14·6	,, moderately worn.
,,	387 ,,	♀	44·0	25·0	—	9·0	22·0	12·0	11·2	—	24·0	11·4	14·0	,, slightly worn.
,,	388 ,,	♂	44·2	25·6	—	10·6	22·0	11·8	12·0	—	24·2	12·0	14·4	,, not worn.
,,	11. 1. 3. 198	♂ juv.	44·2	26·0	11·2	10·2	22·2	12·4	12·6	6·4	24·4	11·4	14·0	,, ,,
,,	11. 1. 3. 197	♀	44·4	25·8	11·6	10·4	—	12·2	12·2	7·4	24·0	11·8	14·2	,, moderately worn.
Jura	Cambridge	♂	49·4	28·4	13·0	14·2	24·6	12·8	13·6	7·4	28·4	13·4	16·2	,, ,,
,,	,,	♂	48·4	27·8	12·2	11·2	23·4	13·0	12·8	7·8	27·2	13·0	15·6	,, slightly worn.

* Type.

♂, 2 ♀.	Graftonbury, Herefordshire.	W. E. de Winton (P).	11. 1. 3. 178–180.
2 ♀.	Tring, Hertfordshire.	Hon. N. C. Rothschild (P).	11. 1. 3. 182–183.
♂.	Felden, Hertfordshire.	——	11. 1. 3. 184.
1.	Nr. Hounslow, Middlesex.	W. Phillips (P).	60. 1. 23. 2.
♀.	Guildford, Surrey.	G. Dalgleish (C & P).	4. 4. 3. 1.
♂ st.	Horsham, Sussex.	Sir E. G. Loder, Bart. (C & P).	6. 7. 14. 1.
♂, ♀.	Mayfield, Sussex.	C. H. B. Grant (C & P).	11. 1. 3. 186–187.
♂.	Selborne, Hampshire.	Dr. R. Bowdler Sharpe (C & P).	2. 11. 29. 1.
♀.	Whitchurch, Hampshire.	W. E. de Winton (C & P).	11. 1. 3. 185.
♂, ♀.	Buckland, Somerset.	R. Hooper (C & P).	11. 1. 3. 190–191.
♀.	Blandford, Dorset.	J. C. Mansell Pleydell (C & P). (*Type* of subspecies.)	98. 5. 13. 2.
2 ♀.	Blandford, Dorset.	W. T. Blanford (C & P).	11. 1. 3. 188–189.

Mustela erminea ricinæ Miller.

1904. *Putorius erminea* Barrett-Hamilton, Ann. Scottish Nat. Hist., v, p. 203, October, 1904.

1907. *Putorius erminea ricinæ* Miller, Ann. and Mag. Nat. Hist., 7th ser., xx, p. 395, November, 1907.

1910. *Putorius ermineus ricinæ* Trouessart, Faune Mamm. d'Europe, p. 80.

Type locality.—Islay House, Islay Island, Scotland.

Geographical distribution.—Islands of Islay and Jura, off coast of south-west Scotland.

Characters.—Size a little less than in *M. erminea stabilis* and about equal to that of *M. e. æstiva*: condylobasal length of skull in adult male, 47 to 50 mm.; mandible in adult male, 27 to 29 mm.; zygomatic arches unusually wide-spreading; posterior extension of palate relatively wider than in any of the other known forms.

Measurements.—External measurements of type (adult male): head and body, 254; tail, 105; hind foot, 43; ear from meatus, 22. Two other males from the type locality: head and body, 270 and 270; tail, 111 and 114; hind foot, 47 and 46. Two adult females from the type locality: head and body, 231 and 234; tail, 95 and 105; hind foot, 38 and 39. Two adult males from Jura: head and body, 220 and 225; tail, 120 and 125; hind foot, 45 and 46·5.

Specimens examined.—Thirteen, six from Jura and seven from Islay (B.M. and Cambridge).

Remarks.—While readily distinguishable from the large true *stabilis* of England, the Islay and Jura stoat will probably prove to be more nearly related to the smaller form occurring on the

mainland of Scotland, when the status of the Scotch animal is more clearly understood.

1.	Islay, Scotland.	H. Morrison (c & p).	7. 10. 9. 1. (*Type* of subspecies.)
♂, 2 ♀.	Islay, Scotland.	H. Morrison (c & p).	11. 1. 3. 196–198.

MUSTELA HIBERNICA Thomas and Barrett-Hamilton.

1895. *Putorius hibernicus* Thomas and Barrett-Hamilton, The Zoologist, 3rd ser., xix, p. 125, April, 1895 (Ireland).

1895. *Putorius hibernicus* Thomas, The Zoologist, 3rd ser., xix, p. 226, June, 1895 (Isle of Man).

1900. [*Mustela*] *hibernica* Schulze, Zeitschr. für Naturwissensch., lxxiii, p. 221.

1910. *Putorius* (*Ictis*) *hibernicus* Trouessart, Faune Mamm. d'Europe, p. 80.

Type locality.—Enniskillen, Co. Fermanagh, Ireland.

Geographical distribution.—Ireland and the Isle of Man.

Diagnosis.—Like *Mustela erminea* but slightly smaller (hind foot in adult male rarely attaining 50 mm.; condylobasal length of skull in adult male, 44 to 50 mm.); ear and upper lip without whitish edging; brown of sides of body usually encroaching on yellowish or whitish of underparts, frequently so much so as to extend completely across throat and middle of belly, the line of demarcation, except in rare instances, very irregular.

External characters.—The general external characters, including the proportion of tail to head and body, and the long, full pencil, are as in *Mustela erminea;* mammæ usually more numerous: *a* 2–2, *i* 3–3 or 4–4 = 10 or 12.

Colour.—Except in the rare instances in which a partial or complete white coat is assumed in winter, the actual colour is very constant throughout the year, and such variation as there is appears to be due chiefly to the greater or less abundance of the long hairs on back. These hairs are a dark glossy brown very nearly the bistre of Ridgway. The hairs of the dense underfur are smoke-grey at base, changing to a yellowish broccoli-brown distally. From the varying combinations of these elements different shades of brown result which range from a yellowish bistre toward isabella-colour, the bistre usually more pure along median dorsal region and on head, the isabella-colour on sides, legs and tail. Upper lip and entire ear concolor with dark area. No dark spot behind angle of mouth. Feet usually dark but frequently varied with whitish, this colour appearing at tips of toes and spreading upwards. Tail without evident lighter area on under side. Underparts varying from a creamy white to a pale straw-yellow. The line of demarcation between the dark and light areas is very variable in both form and position. In the extreme development of the light area the line of demarcation extends along sides in the same position as in *Mustela erminea*, except that it passes somewhat further below ear and eye and ends at or just above angle of mouth. In the extreme

CRANIAL MEASUREMENTS OF *MUSTELA HIBERNICA*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital breadth.	Breadth of rostrum over canines.	Mastoid breadth.	Occipital depth.	Palatal depth behind tooth-rows.	Rostral depth behind canine.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
Ireland: Enniskillen .	95. 4. 5. 1*	♂	44·0	25·8	10·2	10·6	20·4	11·0	11·8	6·6	24·4	12·0	13·0	Teeth slightly worn.
Colebrooke .	152642	♂	44·2	—	11·0	10·6	21·0	11·2	12·0	6·8	24·2	11·2	14·2	,, moderately worn.
,, .	152643	♂	46·0	26·0	10·8	11·0	22·0	12·0	11·8	6·8	25·8	12·4	15·0	,, not worn.
,, .	152639	♀	40·4	21·6	9·2	9·0	18·0	10·6	10·2	5·8	21·4	10·4	12·8	,, ,,
,, .	152644	♀	40·0	21·8	9·0	8·8	18·2	11·0	10·4	6·0	20·4	10·2	12·4	,, ,,
Boardmills .	152645	♂	45·4	26·8	11·8	10·0	21·8	14·2	12·4	7·2	24·8	12·0	14·0	,, slightly worn.
Arthurstown	11. 1. 3. 202	♂	—	—	13·0	12·6	—	—	14·0	8·6	27·6	13·0	16·0	,, ,,
Isle of Man: Santon .	1. 5. 12. 1	♂	50·2	30·4	13·4	12·6	24·0	14·0	13·4	8·4	29·4	13·0	16·4	,, much worn.
,, .	11. 1. 3. 204	♀	43·6	—	9·2	9·6	19·4	11·4	11·4	6·6	23·4	11·4	14·4	,, not worn.
Ramsey .	95. 5. 30. 1	♀	43·8	—	10·4	10·0	20·0	—	11·0	6·8	23·6	11·0	14·0	,, ,,

* Type.

extension of the dark area the brown forms a band 20 mm. wide across throat just in front of fore legs, and spreads over whole median region of belly, so that the white is confined to three patches, one extending from chin to throat-band, another occupying chest between front legs and spreading on inner side of forearm, and the third in region between hind legs and spreading on inner surface of thighs. Between these extremes every gradation may be found, including the most irregular arrangements of isolated dark spots in the regions where the dark cross bands occur.

Skull and teeth.—Except for their slightly smaller size the skull and teeth are indistinguishable from those of *Mustela erminea*. The difference is, however, particularly well marked as compared with the large British *M. erminea stabilis*, the nearest geographical ally.

Measurements. External measurements of type (adult male): head and body, 228; tail, 88; hind foot, 42; ear from meatus, 21. Average and extremes of four males from Cappagh, Waterford: head and body, 271 (256–283); tail, 111 (103–117); hind foot, 48·2 (46–51). Average and extremes of three females from Powerscourt, Co. Wicklow: head and body, 209 (205–221); tail, 78 (77–81); hind foot, 37·6 (36–40). For cranial measurements see Table, p. 399.

Specimens examined.—Forty-four, from the following localities:—
Ireland: Carrick, Donegal, 1; Colebrooke, Fermanagh, 8; Enniskillen, Fermanagh, 2; Clandeboye, Down, 1; Glaslough, Monaghan, 1; Boardmills, Down, 2; Castle Hamilton, Cavan, 1; Mountainstown, Meath, 3; Clonbrock, Galway, 1; Woodfair, Galway, 1; Carna, Galway, 1; Templemore, Tipperary, 1; Geashill, Kings, 1; Powerscourt, Wicklow, 4; Bagenalstown, Carlow, 1; New Ross, Wexford, 4; Arthurstown, Wexford, 2; Cappagh, Waterford, 4; Lismore, Waterford, 1.
Isle of Man: Lewaig, Ramsey, 1; Santon, 2; Tholt-y-Will, Snaefell, 1.

Remarks.—The Irish stoat is strikingly distinct from the other European species of the sub-genus *Mustela*, though superficially resembling certain North American members of the group. It is at once recognizable by the combination of black-tipped, heavily pencilled tail with entirely dark ear and upper lip. It is also the only European stoat in which the line of demarcation on sides of body is irregular and in which the dark colour of sides tends to invade the light ventral area. In exceptional instances* the colour pattern of body is like that of *Mustela erminea*. While the colouring of the body and head suggests that of *Mustela nivalis*, the animal is evidently a true stoat, as shown by the heavily-pencilled, black-tipped tail and the form of the skull.

♂ st.	Carrick, Donegal, Ireland.	Hon. N. C. Rothschild (P).	0. 5. 17. 1.
3 ♂.	Colebrooke, Fermanagh.	Sir D. Brooke (C & P).	11. 1. 3. 199–201.

* In four of the forty-one skins examined.

♂.	Enniskillen, Fermanagh.	J. E. Harting (C & P).	95. 4. 5. 1. (*Type* of species.)
♂ st.	Clandeboye, Down.	Hon. N. C. Rothschild (P).	0. 5. 17. 2.
♂.	Carna, Galway.	Col. J. W. Yerbury (C & P).	93. 1. 6. 1.
st.	Templemore, Tipperary.	E. Lynan (C & P).	99. 7. 3. 1.
2 ♂.	Arthurstown, Wexford.	G. Barrett-Hamilton (C & P).	11. 1. 3. 202-203.
♀.	Ramsay, Isle of Man.	P. M. C. Kermode (C & P).	95. 5. 30. 1.
♀.	Snaefell, Isle of Man.	P. M. C. Kermode (C & P).	11. 1. 3. 204.
♂, 1 al.	Santon, Isle of Man.	J. C. Bacon (C & P).	1. 5 12. 1–2.

MUSTELA NIVALIS Linnæus.

(Synonymy under subspecies.)

Geographical distribution.—Europe from the Arctic coast to the Mediterranean (including the Balearic Islands, Corsica, Sardinia, Sicily, and Malta) and from Great Britain eastward into Asia.

Diagnosis.—Size usually less than in *Mustela erminea* and *M. hibernica*, and tail usually shorter in proportion to length of head and body, the pencil small, its longest hairs not half as long as vertebræ; skull like that of *Mustela erminea*, but with rostral breadth over canines relatively greater, frequently exceeding interorbital breadth, especially in the larger races in which the skull approaches that of *M. erminea* in size; colour much as in *M. erminea*, but brown of upper parts usually (except in Mediterranean races) encroaching on whitish of belly, the line of demarcation irregular; tail with no black except occasionally a tuft in pencil; a white winter pelage in colder portions of range.

External characters.—In general like *Mustela erminea*, but size usually less, and tail relatively shorter (scarcely more than one quarter head and body, except in the forms inhabiting the Mediterranean region), the pencil thin, tapering, never as wide as median portion of tail, its longest hairs only one-quarter to one-third as long as tail vertebræ; palms and soles hairy, the pads bare in summer in northern forms, always in southern forms; ear short but appearing distinctly above fur, its outline evenly rounded, both inner and outer surfaces densely clothed with short hairs; fur as in *M. erminea*. Mammæ: $i\ 4-4 = 8$.

Colour.—Upper parts a yellowish brown similar to that of *Mustela erminea*, but seldom darkening along median dorsal region or on head, the brown usually extending to or covering dorsal surface of feet; underfur throughout the dark regions paler than distal portion of long hairs; underparts and inner surface of legs whitish or yellowish in strong contrast, but line demarcation low on sides of body and usually irregular, the

brown tending to encroach on white to such an extent as occasionally to pass completely across chest, and frequently to form spots and blotches in same region; upper lip usually with some white; a brown spot varying much in size, and sometimes joined with brown of cheek, usually present behind angle of mouth; ear brown like surrounding parts, the rim not whitened; tail concolor with back, the pencil faintly darker or occasionally with black hairs, the median ventral region sometimes faintly paler than rest of tail, but never with definite light stripe. In white winter pelage the entire animal is white or whitish, the tail sometimes with a few black hairs in pencil. The change does not take place regularly except in the colder portions of the animal's range, as in the Alps and central and northern Scandinavia.

Skull and teeth.—The skull resembles that of *Mustela erminea* in all respects except that the interorbital region is often narrower than the rostrum, a character most pronounced in the larger races that approach *M. erminea* in size. Postorbital process frequently more prominent than in *M. erminea*, and zygoma often less evenly bowed upward, its upper border flattened or sometimes with a distinct median concavity and posterior widening as in *M. putorius*. Teeth not distinguishable from those of *Mustela erminea* except by their smaller size.

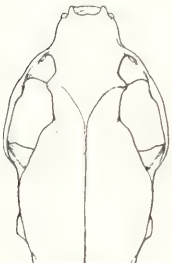

FIG. 82.
Mustela nivalis (male).
Nat. size.

Remarks.—Although the most variable of the European *Mustelidæ* this species is always readily distinguishable externally from the other members of the genus *Mustela* with which it is associated by the short thin pencil. The discrepancy in width between the rostrum and interorbital region, while generally characteristic of the species as compared with *Mustela erminea*, is not perfectly constant. It is invariably well marked, however, in adults of the larger southern animals. Three races are represented in Europe, a smaller northern and central form, and two larger subspecies in the Mediterranean region.

MUSTELA NIVALIS NIVALIS Linnæus.

1766. [*Mustela*] *nivalis* Linnæus, Syst. Nat., I, 12th ed., p. 69.

1777. [*Mustela*] *vulgaris* Erxleben, Syst. Regni Anim., I, p. 471 (Temperate Europe).

1811. *Mustela gale* Pallas, Zoogr. Rosso-Asiat., p. 94 (Renaming of *vulgaris*).

1820. *Mustela minor* Nilsson, Skand. Fauna, I, p. 85 (Renaming of *nivalis*).

1853. *P*[*utorius*] *minutus* Pomel, Catal. Méth. et Descr. Vert. Foss. Loire, p. 51 (Neighbourhood of Paris, France).

1857. *Fœtorius vulgaris* Blasius, Säugethiere Deutschlands, p. 231.

1869. *Fœtorius pusillus* Fatio, Faune Vert. Suisse, I, p. 332 (Not of Audubon and Bachman; substitute for *vulgaris*).

1895. *Putorius nivalis* Thomas, The Zoologist, 3rd ser., XIX, p. 177, May, 1895.

1900. *Putorius nivalis typicus* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., v, p. 42, January, 1900.

1900. *Putorius nivalis vulgaris* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., v, p. 42, January, 1900.

1908. *P[utorius] nivalis* var. *monticola* Cavazza, Ricerche sui "Putorius nivalis" e sui "Putorius ermineus" d'Italia, Bologna, p. 37 (High valleys of the Alps).

1910. *Putorius* (*Ictis*) *nivalis*, *P.* (*I.*) *nivalis vulgaris* and *P.* (*I.*) *vulgaris minutus* Trouessart, Faune Mamm. d'Europe, pp. 81–82.

Type locality.—Province of Vesterbotten, Sweden.

Geographical distribution.—Europe from the Arctic coast to the Alps and Pyrenees, and from Great Britain eastward.

Characters.—Size small: hind foot of adult males 29 to 34 mm.; condylobasal length of skull in adult males usually less than 41 mm. (36 to 42 mm.).

Measurements.—Two adult males from Cromarty, Scotland: head and body, 211 and 215; tail, 65 and 59; hind foot, 34 and 34; ear from meatus, 16 and 15. Two adult females from the same region: head and body, 161 and 174; tail, 39 and 49; hind foot, 24 and 25; ear from meatus, 12 and 12. Two adult males from Guines, Pas-de-Calais, France: head and body, 209 and 212; tail, 60 and 58; hind foot, 31 and 30. Adult male and female from Porté, Pyrénées-Orientales, France: head and body, 213 and 187; tail, 60 and 54; hind foot, 33 and 26. Adult male and female from Hatszeg, Hunyad, Hungary: head and body, 196 and 150; tail, 70 and 41; hind foot, 31·4 and 21. For cranial measurements see Table, p. 408.

Specimens examined.—Ninety-nine, from the following localities:—

SCOTLAND: Thurso, Caithness, 1; Cromarty, 2; South Sutor, Cromarty, 1; Black Island, Cromarty, 1; Elgin, 1; Dava, Elgin, 1 (Wilson); Cortachy, Forfar, 1 (Wilson); Stockbriggs, Lanark, 3; Lamancha, Peebles, 1; Ecclefechan, Dumfries, 2, Wyseby, Dumfries, 1; Jardine Hall, Dumfries, 2 (U.S.N.M.).

ENGLAND: Leeds, Yorkshire, 1 (U.S.N.M.); Grimsby, Lincolnshire, 1; Aberia, Merionethshire, 1; Pembrokeshire, 4; Methwold, Norfolk, 1; Sandringham, Norfolk, 4; Suffolk, 2 (skulls); Histon, Cambridgeshire, 2; Tring, Hertfordshire, 3; Soham Fen, Cambridgeshire, 1; Saffron Walden, Essex, 4; Southall, Middlesex, 1; Eashing, Surrey, 1 (U.S.N.M.); Coleford, Gloucestershire, 1; Froyle, Hampshire, 1; Blandford, Dorset, 1; Poughill, Shalton, Cornwall, 1; Stratton, Cornwall, 1.

NORWAY: Asker, near Christiania, 1.

SWEDEN: Stockholm, 1 (U.S.N.M.).

DENMARK: Helsingor, Zealand, 1 (Copenhagen); Amager, 1 (Copenhagen).

FRANCE: Guines, Pas-de-Calais, 2; Leguevin, near Toulouse, Haute-Garonne, 1; Luchon, Haute-Garonne, 1; Porté, Pyrénés-Orientales, 4; Ax-les-Thermes, Ariège, 1; Barcelonnette, Basses-Alpes, 1.

GERMANY: Brunswick, 1 (U.S.N.M.); Königsberg, 3 (U.S.N.M.);

Nuremberg, Bavaria, 1 (U.S.N.M.); Strass, near Burgheim, Bavaria, 1; Ingelheim, Rheinhessen, 3; South Germany, 4 (skulls).

AUSTRIA-HUNGARY: Haida, Arva, Bohemia, 1; Hainspach, Bohemia, 4 (U.S.N.M.); Csallóköz-Somorja, Pressburg, Hungary, 3; Hatszeg, Hunyad, Hungary, 4.

SWITZERLAND; Thayngen, Schaffhausen, 3 (U.S.N.M.); Andermatt, Uri, 1 (U.S.N.M.); St. Gallen, 1; Mels, St. Gallen, 1 (U.S.N.M.); Wattwil, St. Gallen, 1 (U.S.N.M.); Weiern, St. Gallen, 1 (U.S.N.M.); Züberwangen, St. Gallen, 2 (U.S.N.M.); Oberengadin, 1; Untervatz, Grisons, 1 (U.S.N.M.).

Remarks.—The weasel of central and northern Europe never attains the large size often found in the Mediterranean races. The material at present available is not sufficient to show whether or not the northern animals are all referable to a single form.

♂.	Thurso, Caithness, Scotland.	Mrs. J. Edis (P).	11. 1. 3. 300.
3 ♂.	Cromarty.	G. St. Quentin (C & P).	11. 1. 3. 205, 207, 432.
♂.	Lamancha, Peebles.	J. L. Bonhote (C & P).	11. 1. 3. 433.
2 ♂, ♀.	Stockbriggs, Lanarkshire.	E. R. Alston (C & P).	79. 9. 25. 23, 85–86.
♂.	Aberia, Merionethshire, Wales.	G. H. Caton Haigh (C & P).	11. 1. 3. 443.
4 ♂.	Pembrokeshire.	G. H. Mills (C & P).	11. 1. 3. 444–447.
♂.	Grimsby, Lincolnshire, England.	G. H. Caton Haigh (C & P).	11. 1. 3. 434.
♂.	Norfolk.	Dr. C. Hose (C & P).	11. 1. 3. 208.
♂, ♀.	Sandringham, Norfolk.	H.M. King Edward VII. (P).	96. 4. 13. 2. 3.
2 st.	Sandringham, Norfolk.	H.M. King Edward VII. (P).	96.4. 28. 14–15.
2.	Suffolk.	Col. E. S. Butler (P).	94. 1. 6. 6–7.
♂.	Histon, Cambridgeshire.	Dr. S. F. Harmer (C & P).	11. 1. 3. 206.
♀ (albino)	Soham Fen, Cambridgeshire.	F. Bond (P).	90. 6. 21. 1.
2 ♂, 2 ♀.	Saffron Walden, Essex.	A. Wright (C & P).	11. 1. 3. 436–439.
♂.	Southall, Middlesex.	R. C. Wroughton (C & P).	11. 1. 3. 440.
♂.	Froyle, Hampshire.	W. R. Ogilvie-Grant (C & P).	11. 1. 3. 441.
♀.	Stratton, Cornwall.	W. L. S. Loat (C & P).	11. 1. 3. 442.
juv.	Asker, Christiania, Norway.	Christiania Museum (E).	95. 5. 29. 1.
2 ♂.	Guines, Pas-de-Calais, France.	O. Thomas (C & P).	94. 6. 6. 10–11.
♂.	Luchon, Haute-Garonne. (*A. Robert.*)	O. Thomas (P).	6. 4. 1. 36.
♂.	Leguevin, Haute-Garonne. (*A. Robert.*)	O. Thomas (P).	6. 4. 1. 37.
♂.	Ax-les-Thermes, Ariège.	V. Builles (P).	8. 3. 27. 8.
2 ♂, 1 ♀.	Porté, Pyrénées-Orientales.	G. S. Miller (C).	8. 8. 4. 166–168.
♀.	Barcelonnette, Basses-Alpes. (*C. Mottaz.*)	O. Thomas (P).	8. 8. 10. 44.

♂ juv.	Strass, Burgheim, Bavaria. (*Körbitz.*)	Lord Lilford (P).	11. 1. 1. 96.
3.	Ingelheim, Rheinhessen, Germany.	C. Hilgert (C).	8. 11. 2. 29–31.
4.	South Germany.	Dr. A. Günther (C).	59. 9. 6. 71–73, 122.
3.	Csallóköz-Somorja, Pressburg, 400 ft. Hungary.	Budapest Museum (E).	94. 3. 1. 2–4.
3 ♂, ♀.	Hatszeg, Hunyad, Transylvania.	C. G. Danford (C).	3. 2. 2. 17–19. 3. 11. 8. 19.

Mustela nivalis boccamela Bechstein.

1801. *Mustela boccamela* Bechstein, Gemeinn. Naturgesch, Deutschlands, I, 2nd ed., p. 819 (Sardinia).

1869. *Putorius vulgaris* var. *meridionalis* Costa, Annuario del Mus. Zool. della R. Univ. di Napoli, 1865, p. 40 (Southern Italy).

1900. *Putorius nivalis italicus* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., v, p. 45, January, 1900 (Grezzana, highlands of Verona, Italy). Type in British Museum.

1900. *Putorius nivalis boccamela* Barrett-Hamilton, Ann. and Mag. Hist., 7th ser., v, p. 46, January, 1900.

1900. *Putorius nivalis siculus* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., v, p. 46, January, 1900 (Marsala, Sicily). Type in British Museum.

1901. *Mustela* (*Ictis*) *dombrowskii* Matschie, Sitz.-Ber. Gesellsch. Naturforsch. Freunde, Berlin, p. 231 (Siulnita, Roumania).

1905. [*Fœtorius pusillus*] *major* Fatio, Arch. Sci. Phys. et Nat. Genève, 4th ser., XIX, p. 512, May 15, 1905 (Poschiavo, Grisons, Switzerland; see Mottaz, Bull. Soc. Zool., Genève, I, p. 169, November 15, 1908). Type in Mottaz collection.

1910. *Putorius* (*Ictis*) *boccamela*, *P.* (*I.*) *nivalis meridionalis*, *P.* (*I.*) *nivalis dombrowskii*, and *P.* (*I.*) *nivalis siculus*, Trouessart, Faune Mamm. d'Europe, pp. 81, 83.

Type locality.—Sardinia.

Geographical distribution.—Italy and coast of France as far as the Department of Var; islands of Sicily, Malta and Sardinia; Corsica?

Diagnosis.—Similar to *Mustela nivalis nivalis*, but decidedly larger, and tail relatively longer; hind foot of adult males 34, to 41 mm.; condylobasal length of skull in adult males usually more than 41 mm. (40 to 46–6 mm.).

Measurements.—Two adult males from Valescure, Var, France: head and body, 252 and 250; tail, 88 and 80; hind foot, 37·6 and 38; ear from meatus, 21 and 19. Adult male from Agay, Var, France: head and body, 265; tail, 86; hind foot, 41; ear from meatus, 20. Adult male from vicinity of Genoa, Italy: head and body, 240; tail, 80; hind foot, 37·6. Young adult male from near Verona, Italy (type of *italicus*): hind foot (dry), 32·4. Adult male from Marsala, Sicily: head and body, 250; tail, 90; hind foot, 39. A second male from the same locality (type of *siculus*): hind foot, 34·2. Adult male from Malta:

head and body, 173 ; tail, 62 ; hind foot, 34. For cranial measurements see Table, p. 410.

Specimens examined.—Forty-six, from the following localities :—

France.—Valescure, Var, 2; Agay, Var, 1.

Switzerland : Somvico, Ticino, 1 (U.S.N.M.); Bogno, Ticino, 1 (U.S.N.M.); Buggiolo, Ticino, 1 (U.S.N.M.); San Lucio, Ticino, 1; Poschiavo, Grisons, 4 (U.S.N.M. and Mottaz, including type of *major*). These Swiss specimens are intermediate between *boccamela* and *nivalis*, though nearer the former.

Italy : Padola, Cadore, 1 (Turin), not typical ; Turin, 1 ; near Genoa, 1 ; near Verona, 3 ; near Florence, 2 (U.S.B.M.) ; near Rome, 2.

Sicily : Balestrate, 2 ; Marsala, 3 ; Palermo, 5 (B. M. and U.S.N.M.).

Sardinia : No exact locality, 4 ; Cagliari, 3.

Malta ; No exact locality, 3 ; Ghallis, 4 ; Bingemma Fort, 1.

Roumania ; Malcoci, Dobrudscha, 1 (U.S.N.M.).

Remarks.—Although showing a perplexing amount of individual variation* the weasel of the central Mediterranean region must be regarded as distinct from that of central and northern Europe. A small percentage of southern specimens cannot be identified with certainty ; but typical fully adult males of *boccamela* are strikingly different from the animal occurring north of the Alps.

♂.	Valescure, Var, France.	G. S. Miller (c).	8. 8. 4. 170.
♂.	Agay, Var.	G. S. Miller (c).	8. 8. 4. 169.
♀.	St. Lucio, Ticino, Switzerland. (*E. H. Zollikofer.*)	O. Thomas (p).	2. 8. 4. 27.
♂.	Turin, Italy.	E. Cavendish Taylor (p).	5. 5. 6. 11.
♂.	Genoa, Liguria.	Lord Lilford (p).	95. 11. 4. 1.
2 ♂, 1 ♀.	Verona (*Conte degli Oddi*).	O. Thomas (p).	99. 11. 11. 1–3.
		(99. 11. 11. 1. *Type* of *italicus* Barr.-Ham.)	
♂.	Balestrate, Sicily.	J. I. S. Whitaker (p).	95. 3. 4. 4.
4 ♂.	Palermo.	J. I. S. Whitaker (p).	98. 10. 6. 3.
			95. 3. 4. 1–3.
2 ♂, 1 ♀.	Marsala.	J. I. S. Whitaker (p).	95. 3. 4. 5–7.
		(95. 3. 4. 5. *Type* of *siculus* B.-Ham.)	
♂, 2 al.	Cagliari, Sardinia.	E. N. Buxton (p).	95. 4. 16. 1–3.
3 al.	Sardinia.	Genoa Museum (p).	86. 11. 3. 1–3.
	Sardinia.	Purchased (Linnæa, Berlin).	86. 7. 10. 2.
juv.	Malta.	C. A. Wright (p).	94. 11. 26. 1.
♀.	Malta. (*Micallef.*)	C. A. Wright (p).	95. 1. 2. 1.
3 ♂, 1 ♀.	Ghallis.	C. A. Wright (p).	7. 7. 6. 1–4.
♀.	Bingemma Fort.	C. A. Wright (p).	7. 7. 6. 5.

* Studied in much detail by Cavazza, Ricerche sui "Putorius nivalis" e sui "Putorius ermineus" d'Italia (Bologna, Zanichelli), 1908, Studien über die in Italien vorkommenden Wieselarten der Untergattung Arctogale (Zool. Anzeiger xxxiv, pp. 582–603), 1909, Sulle Donnole e sull' Ermellino in Italia (Boll. Soc. Zool. Ital. xviii), 1909, and Contributo alla conoscenza della vita e delle abitudini della Donnola, *Putorius nivalis*, Linn. (ibid. xix, pp. 65–82), 1910.

Mustela nivalis iberica Barrett-Hamilton.

1900. *Putorius nivalis ibericus* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., v, p. 45, January, 1900. Type in British Museum.
1905. *Putorius hibericus* Seabra, Bol. da Direcç. Gen. da Agricultura, Lisboa, VIII, no. 2, p. 69.
1910. *Putorius nivalis iberica* Trouessart, Faune Mamm. d'Europe, p. 83.

Type locality.—Seville, Spain.

Geographical distribution.—Iberian Peninsula and Balearic Islands.

Diagnosis.—Intermediate in size between *Mustela nivalis nivalis* and *M. n. boccamela*, though nearer the former (hind foot in adult males, 30 to 35; condylobasal length of skull in adult male, 39 to 43 mm.); colour of upper parts a buffy clay-colour, not so dark as in the other races.

Measurements.—Adult male and female from the neighbourhood of Silos, Burgos, Spain: head and body, 225 and 184; tail, 59 and 53; hind foot, 27 and 21·8; ear from meatus, 15 and 13. Two adult males from Majorca, Balearic Islands: head and body, 191 and 250; tail, 79 and 90; hind foot, 32 and 35. Two adult males from Dehesa de Valencia, Spain: head and body, 264 and 278; tail, 62 and 62; hind foot, 32 and 34. Adult male from Seville, Spain (type): hind foot (dry), 31·4. For cranial measurements see Table, p. 411.

Specimens examined.—Twenty-seven, from the following localities:—
Spain: Pajáres, Leon, 1; Panticosa, Huesca, 1; Arrechavaleta, Vitoria, 2; near Burgos, 1; Silos, Burgos, 1; Castrillo de la Reina, Burgos, 2; La Granja, Segovia, 1; Villalba, Madrid, 2; Barracas, Castellon, 2; Dehesa de Valencia, 4; Seville, 3 (including type); Jerez, Cadiz, 1; Muro, Majorca, Balearic Islands, 1; Inca, Majorca, Balearic Islands, 2; Mahon, Minorca, Balearic Islands, 1.
Portugal: Alcochete, 1.

Remarks.—The Iberian weasel appears to be more nearly related to *Mustela nivalis nivalis* than to *M. n. boccamela*. It is distinguishable from both of these by its paler colour.

♀.	Pajáres, Leon, Spain. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 54.
♂.	Panticosa, Huesca. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 58.
2 ♀.	Arrechavaleta, Vitoria. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 59–60.
♂, ♀ juv.	Burgos.	G. S. Miller (C).	8. 8. 4. 50–51.
1 al.	La Granja, Segovia.	M. de la Escalera (C).	8. 7. 30. 8.
♂, ♀.	Villalba, Madrid. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 56–57.
♂.	Barracas, Castellon. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 55.
3 ♂.	Dehesa de Valencia. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 51–53.
♂, ♀.	Bormujo, Seville. (*Dr. A. Ruiz.*)	Lord Lilford (P).	95. 9. 4. 12–13.

CRANIAL MEASUREMENTS OF *MUSTELA NIVALIS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital breadth.	Rostral breadth over canines.	Mastoid breadth.	Occipital depth.	Palatal depth behind tooth-rows.	Rostral depth behind canines.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
M. nivalis nivalis.														
Scotland: Thurso	11. 1. 3. 300	♂	41·0	23·8	8·8	8·8	19·6	10·4	10·2	6·2	22·2	10·0	12·4	Teeth not worn.
Cromarty	11. 1. 3. 205	♂	40·2	23·0	9·4	9·2	19·0	10·4	11·0	6·4	21·8	10·2	12·2	,, moderately worn.
Stockbriggs, Lanarkshire	79. 9. 25. 85	♂	39·0	20±	8·4	8·8	17·4	10·0	10·0	5·8	21·0	10·4	12·4	,, not worn.
Jardine Hall	25099	♂	38·6		8·2	8·4	19·2	9·0	—	6·2	20·8	10·2	12·4	,, slightly worn.
,,	38281	♂	39·8	21·0	9·2	8·6	18·4	10·0	10·0	5·8	21·0	10·2	12·2	,, ,,
Wyseby, Dumfriesshire	152631	♂	38·0	19·6	9·0	8·2	17·0	9·8	9·8	6·0	19·2	9·8	11·4	,, ,,
Ecclefechan ,,	152629	♂	39·2	21 2	9·0	8·8	18·2	10·2	10·0	6·2	20·2	10·2	12·0	,, moderately worn.
England: Sandringham	96. 4. 13. 2	♂	40·4	22·6	9·2	9·2	18·6	10·8	10·0	5·8	21·0	10·4	12·8	,, slightly worn.
Histon, Cambridgeshire	11. 1. 3. 206	♂	42·0	22·0	9·4	9·2	19·0	11·2	10·6	6·6	22·0	11·2	13·0	,, ,,
Methwold, Norfolk	11. 1. 3. 208	♂ juv.	38·0	19·6	8·2	8·4	18·8	9·8	9·4	5·6	20·0	10·0	12·0	,, not worn.
Suffolk	94. 1. 6. 7	♂	38·2	20·8	8·2	8·4	18·2	10·8	10·0	5·8	20·0	9·2	11·6	,, slightly worn.
Tring, Hertfordshire	152625	♂	38·0	21·6	8·8	8·6	18·4±	–	10·0	5·6	20·2	10·0	12·0	,, ,,
Blandford, Dorset	152624	♂	39·4	23·0	9·0	9·2	19·0	11·0	10·2	6·0	20·8	10·0	12·2	,, not worn.
Scotland: Cromarty	11. 1. 3. 207	♀	35·0	17·8	7·2	7·2	16·0	9·2	9·0	5·4	18·4	8·8	10·2	,, moderately worn.
Ecclefechan, Dumfriesshire	152630	♀	34·0	16·2	7·0	6·8	15·0	8·2	8·8	5·0	18·0	8·4	10·2	,, slightly worn.

England: Sandringham . .	96. 4. 13. 3	♀	33·0	17·4	—	7·2	15·4	8·4	8·0	5·0	17·0	8·0	10·0	Teeth slightly worn.	
Tring, Hertfordshire .	152626	♀	32·0	16·4	6·8	6·8	14·6	8·2	8·0	4·8	16·4	7·8	10·0	,,	,,
Eashing, Surrey. .	143678	♀	34·2	17·8	7·8	7·4	15·4	9·0	8·4	5·0	17·2	9·0	10·8	,,	,,
Denmark: Helsingor, Zealand .	1076 (Copenhagen)	♂	37·8	20·0	—	9·0	17·4	—·	9·8	—	19·0	9·8	11·6	,,	?
Amager . . .	649 (Copenhagen)	♂	37·0	19·8	—	9·8	17·2	—	9·4	—	19·4	9·4	11·2	,,	?
France: Guines, Pas-de-Calais .	94. 6. 6. 10	♂	39·0	21·0	8·6	8·8	18·0	9·8	10·0	6·2	20·0	10·0	12·0	,,	moderately worn.
,, ,, .	94. 6. 6. 11	♂	39·2	21·0	8·4	8·8	18·8	10·2	10·0	6·0	20·0	10·0	12·0	,,	slightly worn.
Ax-les-Thermes, Ariège	8. 3. 27. 8	♂	40±	22·4	9·0	—	20·0	10·6	10·2	6·2	22·2	11·0	13·4	,,	,,
Porté, Pyrénées-Orientales	8. 8. 4. 166	♂ juv.	39·4	20·4	8·8	8·2	18·8	11·0	10·0	6·0	21·0	10·4	12·4	,,	not worn.
,, ,,	8. 8. 4. 167	♂	40·6	21·2	9·0	8·8	19·0	11·0	10·0	6·0	22·0	11·0	13·2	,,	moderately worn.
,, ,,	172136	♀	35·0	16·8	7·2	7·0	15·4	—	9·0	5·2	18·0	9·0	10·8	,,	,,
Luchon, Haute-Garonne	—	♀	36·4	18·0	7·6	7·4	16·4	8·6	9·0	5·4	19·0	9·8	12·0	,,	slightly worn.
Germany: Strass, Bavaria . .	—	♀	35·4	18·6	7·6	7·8	15·8	9·0	8·8	5·6	18·0	8·8	10·8	,,	,,
Brunswick . .	85245	♀	32·4	16·0	—	6·0	13·8	8·0	7·8	4·6	16·2	8·2	10·2	,,	,,
Austria-Hungary: Haida, Bohemia . .	—	♂	38·6	22·0	9·2	8·8	18·4	9·8	9·8	5·8	20·4	10·0	11·6	,,	moderately worn.
Hatszeg, Hunyad . .	3. 2. 2. 18	♂	39·6	—	8·6	8·6	19·0	9·6	10·0	6·0	20·6	10·2	12·8	,,	slightly worn.
,, ,,	3. 2. 2. 19	♀	31·0	16·0	6·6	6·8	14·2	7·6	7·4	4·6	16·0	7·8	9·2	,,	,,
Switzerland: Thayngen, Schaffhausen . .	145155	♂	36·2	17·4	7·6	7·2	16·8	9·0	9·4	5·2	19·0	9·0	11·2	,,	,,
,, ,,	123638	♀	33·2	17·0	7·2	6·6	15·4	8·6	8·0	4·8	17·4	8·6	10·0	,,	not worn.
Untervatz, Grisons	115209	♀	30·2	14·2	5·8	6·0	13·0	8·2	7·4	4·2	14·8	7·4	9·6	,,	slightly worn.

CRANIAL MEASUREMENTS OF *MUSTELA NIVALIS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital breadth.	Breadth of rostrum over canines.	Mastoid breadth.	Occipital depth.	Palatal depth behind tooth-rows.	Rostral depth behind canine.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
M. nivalis boccamela.														
France: Valescure, Var.	172133	♂	44·0	24·0	10·0	10·0	21·4	11·8	10·8	7·0	21·2	11·4	14·0	Teeth moderately worn.
,, ,,	8. 8. 4. 170	♂	44·0	25·2	10·4	10·6	21·4	11·6	11·6	7·0	24·4	11·6	14·2	,, slightly worn.
Agay ,,	8. 8. 4. 169	♂	46·6	27·0	10·6	10·8	22·2	11·8	11·6	7·0	26·0	12·0	15·0	,, moderately worn.
Switzerland: Poschiavo	Mottaz*	♂	41·6	21·0	9·0	8·0	19·4	10·4	10·4	6·0	22·4	11·0	13·4	,, not worn.
,,	145159	♀	36·2	17·0	7·2	7·2	16·0	8·2	8·4	5·4	18·8	9·2	11·2	,, ,,
San Lucio	2. 8. 4. 27	♀ juv.	33·6	16·8	6·8	7·2	16·0	9·8	8·2	4·8	17·2	8·4	10·2	,, ,,
Italy: Turin	5. 5. 6. 11	♂	—	—	9·8	10·2	—		11·4	7·0	23·6	11·4	13·8	,, ,,
Genoa	95. 11. 4. 1	♂	44·0	24·0	10·0	10·2	21·0	11·8	11·0	7·0	23·8	11·4	14·0	,, slightly worn.
Verona	99. 11. 11. 1†	♂	42·0	22·0	9·0	9·0	20·0	10·6	10·0	6·4	23·0	11·0	13·0	,, not worn.
,,	99. 11. 11. 2	♂	40·2	22·4	9·0	9·8	19·0	10·0	10·4	6·4	21·8	11·0	13·4	,, ,,
Florence	105397	♂	42·8	24·2	9·0	9·4	20·0	10·2	10·4	6·4	23·2	11·2	13·6	,, ,,
Sicily: Palermo	95. 3. 4. 1	♂	43·6	24±	9·0	10·0	21·0	—	10·4	7·0	24·0	11·0	14·2	,, slightly worn.
,,	95. 3. 4. 2	♂ juv.	44·4	24·0	9·2	10·0	21·6	11·8	11·0	7·0	24·8	11·0	14·0	,, ,,
,,	98. 10. 6. 3	♂	40±	23±	9·2	10·2	19·0	—	10·2	6·6	21·4	11·0	12·4	,, not worn.
Marsala	95. 3. 4. 5‡	♂	41·4	24·0	8·6	9·2	20·0	—	9·8	6·8	22·4	10·8	13·0	,, ,,
,,	95. 3. 4. 6	♂	44·0	24·6	10·0	10·2	21·0	10·8	11·4	7·2	25·0	11·6	14·0	,, ,,
Balestrate	95. 3. 4. 4	♂ juv.	—	—	9·0	9·8	—	—	10·4	6·2	23·6	11·4	13·8	,, ,,
Sardinia	86. 7. 10. 2	♂	42·8	25·0	9·8	9·8	22·0	11·0	11·0	6·8	23·4	10·4	13·2	,, slightly worn.
,,	86. 11. 3. 2	♂	42·4	23·6	9·0	9·2	21·0	11·0	10·0	6·2	23·0	11·0	13·0	,, ,,
,,	95. 4. 16. 3	♂ juv.	41·0	—	9·2	10·2	—	11·2	10·4	6·0	22·0	10·4	13·0	,, not worn.

Malta	7. 7. 6. 1	♂	46±	26·0	9·8	11·4	22·0	—	11·2	7·2	25·0	11·8	14·0	Teeth slightly worn.
,,	7. 7. 6. 3	♂	—	—	9·8	10·0	—	10·8	11·0	7·8	—	12·0	14·0	,, ?
Roumania: Malcoci, Dobrudscha	122114	♂	41·2	22·2	8·2	9·0	19·4	10·2	10·0	5·8	22·0	10·4	13·0	,, slightly worn.
Italy: Verona	99. 11. 11. 3	♀	33·8	17·4	6·8	8·6	15·8	8·2	8·0	5·0	16·4	9·0	10·4	,, not worn.
Padola, Cadore	Festa 18	♀	34·2	18·4	7·8	7·0	16·0	9·0	8·6	4·8	17·2	8·8	10·2	,, slightly worn.
Sicily: Balestrate		♀	35±	—	6·4	7·0	—	—	—	4·8	16·8	8·8	10·4	,, ,,
Malta	7. 7. 6. 4	♀	—	—	8·0	8·6	—	9·0	9·0	6·0	—	10·4	12·8	,, ,,
,,	95. 1. 2. 1	♀	40±	23·0	9·0	9·2	20·4	—	10·0	7·2	22·6	11·2	13·2	,, moderately worn.
M. nivalis iberica.														
Spain: Inca, Majorca, Balearic Islands	0. 7. 1. 7	♂	37·4	19·8	8·0	8·8	18·8	10·4	9·0	5·8	20·2	9·8	11·6	,, not worn.
,, ,,	0. 7. 1. 8	♂	43±	23·0	9·2	9·8	20·4	—	10·0	6·4	23·8	11·2	13·8	,, ,,
Maro	1. 6. 1. 5	♂	43±	22·8	9·0	10·0	21·6	—	10·4	6·6	24·4	11·0	13·6	,, ,,
Silos, Burgos	172131	♂ juv.	40·0	20·4	8·8	9·8	19·0	10·8	10·0	6·2	21·4	10·6	13·0	,, ,,
near Burgos	8. 8. 4. 51	♂ juv.	38·0	19·2	7·6	8·4	18·0	10·0	9·8	5·6	20·0	10·0	12·0	,, ,,
Panticosa, Huesca	8. 2. 9. 58	♂	39·6	22·2	7·6	8·0	18·6	10·2	9·6	5·6	21·8	10·2	12·6	,, ,,
Barracas, Castellon	8. 2. 9. 55	♂	42·4	25·4	9·0	10·8	22·0	11·2	11·2	6·8	24·0	11·2	13·6	,, moderately worn.
Valencia	8. 2. 9. 52	♂	43·0	—	9·0	9·2	19·0	11·0	10·4	6·6	23·0	11·0	13·2	,, slightly worn.
,,	8. 2. 9. 53	♂ juv.	40·0	23·0	9·0	9·2	20·0	9·8	10·4	6·2	21·6	10·4	13·0	,, not worn.
,,	152635	♂	41·8	22·0	9·2	9·4	19·6	10·6	11·0	6·6	22·0	11·0	13·0	,, slightly worn.
,,	8. 2. 9. 51	♂	38·0	22·0	9·0	8·6	18·4	10·8	10·0	6·0	20·4	10·0	12·4	,, ,,
Seville	95. 3. 3. 10§	♂	40·0	22·2	8·8	9·4	19·2	—	10·0	6·2	22·0	10·2	12·2	,, ,,
,,	95. 9. 4. 12	♂	39·2	—	7·8	8·8	—	10·6	9·2	6·0	21·2	10·6	12·2	,, not worn.
Villa Carlos, Majorca	0. 8. 13. 1	♀	36·6	18·0	7·6	7·4	17·4	9·4	8·4	5·6	19·0	9·4	11·4	,, ,,
Castrillo, Burgos	172132	♀	36·4	17·4	8·0	7·8	16·0	8·8	8·4	5·6	19·0	9·2	11·0	,, slightly worn.
Villalba, Madrid	8. 2. 9. 57	♀	36·0	18·0	7·8	9·2	17·4	9·0	9·0	5·6	19·0	9·8	11·4	,, moderately worn.
Barracas, Castellon	152638	♀	35·0	18·0	7·6	7·6	16·8	8·4	8·8	5·4	18·0	9·0	11·2	,, slightly worn.

* Type of *major* Fatio.
‡ Type of *siculus* Barrett-Hamilton.
† Type of *italicus* Barrett-Hamilton.
§ Type.

♀.	Seville. (*Dr. A. Ruiz.*)	Lord Lilford (P).	95. 3. 3. 10. (*Type* of sub-species.)
♂.	Jerez.	A. Chapman (C & P).	9. 4. 24. 1.
1.	Alcochete, Portugal.	Lisbon Museum (E).	3. 11. 13. 1.
♂.	Muro, Majorca, Balearic Islands. (*M. Riutort.*)	O. Thomas (P).	1. 6. 1. 5.
2.	Inca, Majorca.	O. Thomas and R. I. Pocock (C & P).	0. 7. 1. 7–8.
♀.	Mahon, Minorca.	O. Thomas (P).	0. 8. 13. 1.

MUSTELA AFRICANA Desmarest.

1818. *Mustela africana* Desmarest, Nouv. Dict. d'Hist. Nat., XIX, p. 376 ("Africa").

1895. *Putorius africanus* Thomas, Proc. Zool. Soc. London, p. 128 (Malta and Egypt).

1900. *Putorius nivalis africanus* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., V, p. 47, January, 1900.

1908. ? *P*[*utorius*] *nivalis* var. *corsicanus* Cavazza, Ricerche sui "Putorius nivalis" e sui "Putorius ermineus" d'Italia, Bologna, p. 37 (Corsica).

1910. *Putorius* (*Ictis*) *nivalis subpalmatus* Trouessart, Faune Mamm. d'Europe, p. 85.

Type locality.—Said to be Africa (no exact locality stated), but more probably the Azores, as the type came to Paris through the museum of Lisbon, Portugal.

Geographical distribution. Egypt, Malta, San Thomé, Azores.

Diagnosis.—Like *Mustela nivalis boccamela* but larger (hind foot of male, 44 to 49 mm., condylobasal length of skull, 48 to 50 mm.), tail relatively longer (nearly half as long as head and body) and brown of sides usually spreading on underparts, the line of demarcation very irregular.

Colour.—The colour does not differ noticeably from that of *Mustela nivalis boccamela*. Upper parts wood-brown, in some specimens clear and light, in others dark and strongly tinged with raw-umber, the head usually concolor with body but sometimes distinctly darker. Tail concolor with back above, not so dark below, the pencil usually darker than rest of tail and occasionally blackish. Underparts pale cream-buff or buffy white, the light area on chest and belly much encroached on by brown of sides, which occasionally passes completely across, leaving only a few spots of white. Muzzle and upper lip entirely brown, or with a trace of white in front.

Skull and teeth.—The skull resembles that of *Mustela nivalis boccamela* so closely that I can detect no characters others than its larger size by which it can be distinguished. In size it fully equals ordinary skulls of *M. erminea;* but the much broader rostrum as compared with interorbital region serves at once to distinguish it. The teeth show no tangible characters by which they may be differentiated from those of *M. n. boccamela* except that the carnassial is more robust and the small premolars in

CRANIAL MEASUREMENTS OF *MUSTELA AFRICANA*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital breadth.	Breadth of rostrum over canines.	Mastoid breadth.	Occipital depth.	Palatal depth behind tooth-rows.	Rostral depth behind canines.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
Egypt: Cairo . .	8. 4. 2. 34	♂	50·4	27±	10·4	12·2	24·0	—	12·0	8·6	28·0	13·0	15·8	Teeth slightly worn.
,, . .	8. 4. 2. 36	♂	50·0	28·0	11·2	12·2	25·4	14·0	12·2	8·8	28·4	13·0	15·4	,, moderately worn.
,, . .	8. 4. 2. 37	♀	—	28±	11·2	12·2	—	—	11·6	8·6	27·4	12·6	15·2	,, slightly worn.
,, . .	92. 7. 15. 8	♀ juv.	45·4	24·0	9·2	11·0	22·0	12·2	10·2	7·0	25·0	11·4	14·0	,, not worn.
Malta . . .	75. 4. 6. 1	♂	—	—	10·0	11·8	—	—	11·8	7·8	27·0	13·2	15·6	,, slightly worn.
San Thomé . . .	4. 1. 1. 5	♂	48±	27·0	10·4	12·2	—	—	11·8	8·0	27·0	12·4	15·4	,, ,,
Azores: Terceira . .	3. 6. 5. 25	♂	48·0	28·0	11·0	12·0	25·0	13·0	11·8	8·0	27·6	12·4	15·4	,, ,,
,, . .	4. 3. 15. 1	♂	—	27·0	10·6	12·0	—	—	11·6	8·0	26·8	12·4	15·0	,, ,,
St. Michaels .	5. 1. 9. 1	♀	43·0	23±	9·2	10·6	21·6	11·4	10·4	7·2	23·6	11·0	13·0	,, moderately worn.

both jaws tend to be more crowded, so that their crowns are usually set more obliquely to axis of tooth-row.

Measurements.—Two adult males from Terceira, Azores: head and body, 255 and 266; tail, 105 and 116; hind foot, 44 and 44; ear from meatus, 19 and 18. Adult from Malta: hind foot, 44; ear from meatus, 19.

Specimens examined.—Five, from the following localities:—Malta, 1; San Thomé, 1; Terceira, Azores, 2; St. Michaels, Azores, 1.

Remarks.—This African species probably owes its presence in Malta and on the Azores to introduction by man. So far as can be judged from the description, the Corsican weasel to which Cavazza has applied the name *corsicanus*, is the same animal.

1.	Malta.	C. A. Wright (P).	75. 4. 6. 1.
1.	San Thomé.	Hon. W. Rothschild (P).	4. 1. 1. 5.
♂.	Terceira, Azores. (*W. R. Ogilvie-Grant.*)	Hon. W. Rothschild (P).	3. 6. 5. 25.
♂.	Terceira.	D. H. Chassereau (C & P).	4. 3. 15. 1.
♀.	St. Michaels.	Major F. A. Chaves (C & P).	5. 1. 19. 1.

MUSTELA GALINTHIAS Bate.

1906. *Putorius nivalis galinthias* Bate, Proc. Zool. Soc. London, 1905, II, p. 319, April 5, 1906.

1910. *Putorius* (*Ictis*) *nivalis galinthias* Trouessart, Faune Mamm. d'Europe, p. 14.

Type locality.—Crete.

Geographical distribution.—Island of Crete.

Diagnosis.—Similar to *Mustela africana*, but with brown of sides not encroaching on underparts, the line of demarcation straight. Skull not known.

Specimens examined.—Two, both from Crete.

Remarks.—Further material may show that the Cretan weasel is not distinct from *Mustela africana*. The two specimens now known are alike in colour and different from any of the African or other skins of *M. africana* examined. Though without skulls or measurements they evidently represent a weasel quite equal to the African animal in size.

♂.	Malaxa, Crete.	Miss D. Bate (C).	5. 12. 2. 23.
1.	Crete.	Miss D. Bate (C). (*Type* of species.)	5. 12. 2. 24.

Sub-Genus **LUTREOLA** Wagner.

1841. *Lutreola* Wagner, Schreber's Säugthiere, Suppl., II, p. 239 (*lutreola*).
1843. *Vison* Gray, List. Spec. Mamm. Brit. Mus., p. 64 (*vison*).
1857. *Fœtorius* Blasius, Säugethiere Deutschlands, p. 219 (part).
1871. *Hydromustela* Bogdanow, Труд. Общ. Естеств. Казанск. Универс. I, Mem. I, p. 167.

Type species.—*Mustela lutreola* Linnæus.

Geographical distribution.—Northern portion of northern hemisphere from eastern Germany to the Atlantic coast of North America.

Characters.—Form moderately slender; tail bushy; fur modified for aquatic life; skull without noticeably projecting mastoid processes; auditory bullæ sub-triangular; premolars more prehensive than in *Putorius;* inner lobe of upper carnassial functioning against apex of pm_4; anterior border of pm^3 shearing against posterior border of pm_3; point of pm^2 opposed to posterior border of pm_2.

Remarks.—Though well characterized in its extreme development, as represented by the type species and the American forms, the sub-genus *Lutreola* grades insensibly into true *Mustela* through such Asiatic members of the genus as *Mustela sibirica*, *M. canigula* and others. So complete is this intergradation that it may well be questioned whether the name *Lutreola* should be allowed to remain in use. The only typical Old World species ranges westward into south-western France.

MUSTELA LUTREOLA Linnæus.

1766. [*Mustela*] *lutreola* Linnæus, Syst. Nat. I, 12th ed., p. 66 (Finland).
1777. [*Lutra*] *minor* Erxleben, Syst. Regni Anim., I, p. 451 (Renaming of *lutreola*).
1792. *M*[*ustela*] *Lutra fulva* Kerr, Anim. Kingd., p. 173 (Renaming of *lutreola*).
1839. ? [*Mustela lutreola*] var. *alba* De Sélys-Longchamps, Études de Micromamm., p. 46 (*nomen nudum*).
1857. *Fœtorius lutreola* Blasius, Säugethiere Deutschlands, p. 234.
1863. ? *Putorius alpinus* Ogérien, Hist. Nat. du Jura, III, p. 59 (highest portions of the Jura).
1879. *Lutreola europæa* Homeyer, Zool. Garten, XXVI, p. 184, June, 1879 (Substitute for *lutreola*).
1910. *Putorius* (*Lutreola*) *lutreola* Trouessart, Faune Mamm. d'Europe, p. 75.

Type locality.—Finland.

Geographical distribution.—Northern Asia, westward to Finland and south-western France, southward to eastern Roumania; limits of range not known. European distribution less extensive than formerly.

Diagnosis.—General characters as in the sub-genus *Lutreola;* colour throughout a rich dark brown, the region about the mouth whitish, the tip of tail blackish; head and body about 350 to

400 mm., condylobasal length of skull ranging about from 57 to 65 mm.

Colour.—Back, sides and underparts a rich glossy dark brown, nearly the mars-brown of Ridgway, the hairs of underfur between hair-brown and mars-brown, darker at tips than at base, the longer hairs raw-umber, showing a faint greyish cast in certain lights; head slightly darker than back, especially on region in front of eyes; interramia and lips to level of middle of muzzle pad whitish; feet sepia; tail similar to body, but becoming blackish at tip.

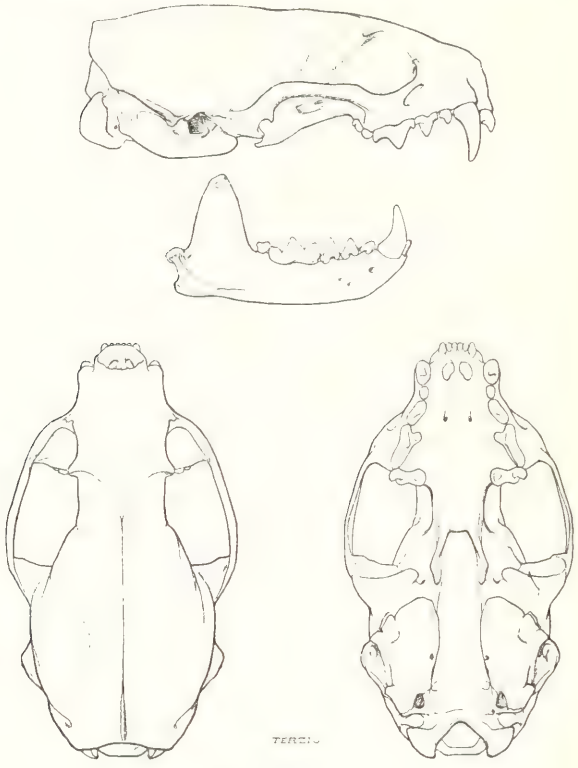

FIG. 83.
Mustela lutreola. Nat. size.

Skull.—The skull is about as large as in females of *Mustela putorius*. In form it is narrower and less deepened than in *M. putorius*, especially in interorbital region, the dorsal profile

CRANIAL MEASUREMENTS OF *MUSTELA LUTREOLA*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital breadth.	Breadth of rostrum over canines.	Mastoid breadth.	Occipital depth.	Palatal depth behind tooth-rows.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
France: Vinsac, Gironde	2975 Lataste	♂	64±	39·0	15·4	15·0	—	—	15·8	40·4	19·2	23·0	Teeth slightly worn.
,, ,,	3270 ,,	♂	64±	—	14·6	14·4	—	—	15 2	38·2	19·2	22·0	,, ,,
Laval, Mayenne	3678 ,,	♂	61·2	34·0	13·2	13·8	29·8	17·8	14·2	35·8	18·4	20·8	,, ,,
,, ,,	3679 ,,	♀	57·8	31·8	11·8	11·8	28·2	16·0	13·4	33·6	17·0	20·0	,, ,,

less convex throughout and in particular less bent downward anteriorly; depth of rostrum at level of front of carnassial barely equal to distance from carnassial to front of premaxillary instead of appreciably greater; orbit larger and more widely open posteriorly than in *M. putorius*, a peculiarity due chiefly to the very slight development of postorbital angle on upper margin of zygoma; auditory bulla moderately inflated, irregularly almond-shaped in outline, its width barely half its length, the meatus slightly projecting but not tubular.

Teeth.—The teeth are less robust but more prehensive than those of *Mustela putorius*, the former peculiarity best shown by the upper carnassial, the latter by the premolars seen in profile when jaws are closed. In the upper carnassial the transverse diameter behind inner lobe is distinctly less than in *M. putorius*, the anterior cingulum cusp is better developed, the main cusp is lower, and the posterior cutting edge has a concave or nearly horizontal posterior portion rather longer than the abruptly sloping anterior portion (in *M. putorius* the cutting edge when unworn slopes directly from apex of main cusp to base of posterior cusp). Small premolars fitting closely against each other when jaws are shut; posterior lower premolar cutting against anterior surface of upper carnassial and posterior surface of pm^3, instead of being widely removed from carnassial and fitting distinctly inside of pm^3.

Measurements.—Adult male and female from Laval, Mayenne, France (skins): head and body, 400 and 350; tail, 140 and 130; hind foot, 59 and 53. Adult from Malcoci, Dobrudscha, Roumania (skin): head and body, 380; tail, 130; hind foot, 52. For cranial measurements see Table, p. 417.

Specimens examined.—Six, from the following localities:—

France: Vinsac, Gironde, 2 (Lataste); Soulac, Gironde, 1 (Lataste); Laval, Mayenne, 2 (Lataste).

Roumania: Malcoci, Dobrudscha, 1 (Schlüter).

Sub-Genus **PUTORIUS** Cuvier.

1817. *Putorius* Cuvier, Règne Animal, i, p. 147 (Type by tautonymy *Mustela putorius* Linnæus).

1840. *Fœtorius* Keyserling and Blasius, Wirbelthiere Europas, p. 66 (*putorius*).

1857. *Fœtorius* Blasius, Säugethiere Deutschlands, p. 219 (part).

1877. *Cynomionax* Coues, Fur-bearing Animals, p. 99 (*Putorius nigripes* Audubon and Bachman).

Type species.—*Mustela putorius* Linnæus.

Geographical distribution. Mediterranean region and central Europe from Great Britain eastward into China; central United States; exact limits of range not known.

Characters.—Form moderately slender; tail bushy; fur not modified for aquatic life; skull with noticeably projecting

angular mastoid processes; auditory bullæ distinctly triangular in outline; inner lobe of upper carnassial functioning against paraconid of lower carnassial; interrelationships of teeth essentially as in *Mustela*, but small premolars more robust and less trenchant.

Remarks.—The sub-genus *Putorius*, with three species in the Old World and one in America, appears to be the most sharply defined of the three groups into which the genus *Mustela* is now divided. No intermediate forms are known connecting it with either *Lutreola* or true *Mustela*, and if none are found the group will probably be regarded as a distinct genus. Two of the Old World species occur in Europe, but only one comes within the scope of the present work.

MUSTELA PUTORIUS Linnæus.

(Synonymy under subspecies.)

Geographical distribution.—Europe from Great Britain eastward, and from the Mediterranean coast to central Scandinavia. Eastern limit of range not known.

Diagnosis.—Skull with wide brain-case and conspicuously angular projecting mastoid region, the mastoid breadth decidedly greater than distance from basion to palation; auditory bullæ slightly longer than broad, triangular in outline; size nearly equal to that of the martens (head and body of adult male about 400 mm.); form slender, fur coarse, tail rather bushy, tapering; colour buffy grey or yellowish overlaid with black, the underparts darker than back.

External characters.—Form much as in the members of the sub-genus *Mustela*, but appearing less attenuate on account of the longer fur and somewhat bushy tail. Underfur rather dense and woolly, about 25 mm. long in winter, 15 mm. in summer; longer hairs coarse and loose, very different in quality from the underfur and not concealing it, their length at middle of back about 40 mm. in winter, somewhat less in summer; tail about one-third as long as head and body, rather bushy, its underfur evident, the longer hairs about 30 mm. in length at middle, decreasing in length toward tip so that the tail tapers noticeably from basal half outward. Feet moderately long, more robust than in true *Mustela*, the plantar and palmar tubercles larger, bare in summer, furred in winter, the soles always thickly furred; claws of front feet about 6 mm. in length, rather strongly curved and partly retractile, those of hind feet about 4 mm. long, slightly curved, not retractile. Head somewhat flattened, muzzle rather wide; eyes small; ear low, rounded, never conspicuously overtopping fur, its height from crown seldom exceeding 15 mm. Mammæ: $i\ 4 - 4 = 8$.

Colour.—Feet, tail, chest and intercrural region blackish, rest of body with long black hairs producing a clouded effect over

buffy grey or yellowish under fur, the two elements of the pelage distinct and not intimately blending, the black more predominant in winter than in summer, the exact shade of underfur ranging from a light buffy grey with pale ecru-drab bases to the hairs to a clear buff-yellow throughout; middle of belly usually like back and sides and conspicuously lighter than intercrural region and chest; chin, interramia and upper lip to muzzle pad whitish tinged with buffy grey, this light area, somewhat dulled by admixture of brownish hairs, extending upward posteriorly as a broad band running between ear and eye (usually not reaching latter) and across forehead, where it curves slightly forward; face in front of light band dark brown to muzzle; ear whitish grey, the orifice covered by a tuft of dark brown hairs.

Skull.—The skull is robust and strongly built, rather flat, with short rostrum, short, broad brain-case, and long, nearly parallel-sided postorbital constriction. Dorsal profile nearly flat from slightly overhanging lambda to between postorbital processes, then abruptly bent downward at an angle of about 30°, the slanting portion less than half as long as the horizontal. Occiput squarely truncate, the condyles sometimes visible from above, sometimes concealed by the lambdoid crest. Brain-case ovate when viewed from above, its outline obscured by the strongly developed angularly projecting mastoid region; sagittal crest low or obsolete except in fully adult individuals, joining lambdoid crest at middle of a shallow median concavity in outline of latter; lambdoid crest well developed, slightly overhanging. Floor of brain-case with slight median longitudinal ridge and shallow lateral depressions; a transverse depression in front of lip of foramen magnum. Auditory bullæ moderately inflated, especially along inner edge, about three-quarters as wide as long; the general outline triangular with anterior border shortest, the meatus not tubular; anterior extremity of bulla not in contact with hamular, and separated from foramen ovale by an oblique ridge which is marked off from glenoid process by a deep conspicuous notch, the distance between bulla and foramen about one-third that between foramina. Postorbital region forming a conspicuous nearly parallel-sided neck between brain-case and postorbital processes, a character peculiar to this species and to *Lutra lutra* among European *Mustelidæ*. Interorbital region slightly broader than rostrum, moderately convex longitudinally, a little more convex laterally; postorbital processes short but distinct, directed slightly backward. Rostrum short and heavy, the width across canines equal to distance from gnathion to anteorbital foramen. Orifice of anteorbital foramen moderately large, over anterior root of carnassial, and wholly beneath anterior rim of orbit, the plate dividing foramen from orbit fully as wide as foramen. Zygomata compressed, moderately spreading, widest apart posteriorly, the orbital process short but distinct,

followed by a broad, shallow concavity and a rather abrupt posterior convexity. Palate moderately broad, its width between molars equal to a little less than twice greatest diameter of

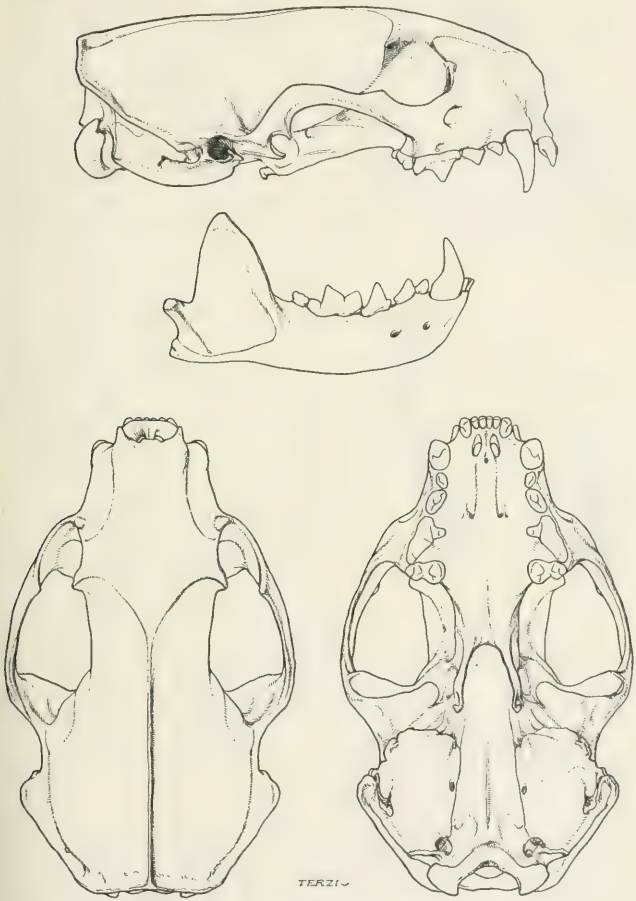

FIG. 84.
Mustela putorius. Nat. size.

molar; incisive foramina small, broadly ovate, oblique, in front of canines and very close behind alveoli of incisors, the minute median foramen between or behind posterior border; posterior

extension of palate longer than broad, emarginate posteriorly; mesopterygoid fossa parallel sided except for its anterior convexity, its total length nearly equal to that of posterior extension of palate, the slender hamulars hooked outward. Mandible robust, its lower margin faintly convex from broad, ill-defined angular process to middle; coronoid process high, triangular, the anterior border slightly the longest.

Teeth.—Relatively to size of skull the teeth are robust and strong, though not unusually so. Incisors as in *Martes martes*, but posterior shelf of i^1 and i^2 less developed, and i^3 less strongly contrasted in size with the two other teeth. Canines lower and more robust than in *Martes* and enamel of lower tooth usually less rugose. Anterior premolar both above and below (pm^2 and pm_2) small, single-rooted, the crown area about equal to that of outer upper incisor, the ill-developed cusp at front of crown, its height scarcely equal to width of tooth. Middle upper premolar (pm^3) two-rooted, compressed, the outline of crown flattened-elliptical when viewed from below, triangular when viewed from the side, the apex slightly in front of middle, the height a little less than length; cingulum very slightly developed, though rather evident at anterior and posterior borders of crown. Posterior lower premolar (pm_4) essentially like pm^3 but larger and relatively higher, its crown less compressed posteriorly. Middle lower premolar (pm_3) intermediate in size and form between pm_2 and pm_4. Upper carnassial essentially like that of *Martes foina*, but with inner lobe usually even more reduced, anterior border of main cusp less oblique, and posterior cusp slightly larger. Lower carnassial with crown nearly 2½ times as long as wide, the main trenchant portion of the tooth formed by the paraconid and protoconid, which are essentially similar to those of *Martes*, though a little more compressed; no trace of metaconid: posterior heel relatively small, its width distinctly less than that of base of protoconid, its surface crossed by a low but evident longitudinal trenchant ridge, the outer surface of which sheers against inner surface of paracone and metacone of upper molar. Second lower molar terete, flat, with slight median longitudinal ridge, its crown area about equal to that of heel of carnassial. Upper molar irregularly pandurate in outline, the inner section slightly larger than the outer, the constriction evident though not deep; protocone low, terete, at middle of inner section of tooth; paracone and metacone small, confluent, the paracone slightly larger than protocone, the metacone much

FIG. 85.

Mustela putorius. Teeth. × 1½.

smaller, the outer border of crown slightly notched in region between cusps.

Remarks.—In certain conditions of pelage *Mustela putorius* bears a superficial resemblance to *Martes foina*, though the two animals may always be distinguished by the different form of the ears. Two geographical races are at present recognized, though their status is far from well understood.

The ferret, *Martes furo* Linnæus,* though usually assumed to be a domesticated variety of *Mustela putorius*, appears to be related to the Asiatic *M. eversmanni* Lesson.† This is shown by the deeply constricted postorbital region, the less triangular, more inflated auditory bullæ, and the smaller size of the carnassial teeth both above and below, characters by which the few skulls of ferrets that I have examined may at once be distinguished from those of *Mustela putorius*, but which render them practically identical with those of the Eastern form.

Mustela putorius putorius Linnæus.

1758. [*Mustela*] *putorius* Linnæus, Syst. Nat., I, 10th ed., p. 46.

1785. *Mustela iltis* Boddaert, Elenchus Animalium, p. 87 (Renaming of *putorius*).

1797. *M*[*ustela*] *furo-putorius* Link, Beyträge zur Naturgesch., I, p. 83 (Based on a melanistic *putorius* popularly regarded as a hybrid between *furo* and *putorius*).

1798. *Viverra foetens* Thunberg, Beskrifning på Svenske Djur, p. 15 (Renaming of *putorius*).

1801. *M*[*ustela*] *p*[*utorius*] *albus* Bechstein, Gemeinn. Naturgesch. Deutschlands, I, 2nd ed., p. 782. Not *Mustela foina alba* l.c. p. 759 (Thüringen, Germany).

1827. *P*[*utorius*] *vulgaris* Griffith, Cuvier's Anim. Kingd., V, p. 120 (Renaming of *putorius*).

1839. ? [*Mustela putorius*] var. *flavicans* De Sélys-Longchamps, Études de Micromamm., p. 145 (*nomen nudum*).

1839. ? [*Mustela putorius*] var. *vison* De Sélys-Longchamps, Études de Micromamm., p. 145 (*nomen nudum*).

1843. *Putorius fœtidus* Gray, List Spec. Mamm. Brit. Mus., p. 64 (Renaming of *putorius*).

1857. *Fœtorius putorius* Blasius, Säugethiere Deutschlands, p. 222.

1863. *Putorius infectus* Ogérien, Hist. Nat. du Jura, III, p. 59 (Substitute for *putorius*).

1904. *Putorius putorius* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., XIII, p. 389, May, 1904.

1904. *Putorius putorius manium* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., XIII, p. 390, May, 1904 (Teufen, Appenzell, Switzerland). Type in British Museum.

1910. *Putorius putorius* and *P. putorius manium* Trouessart, Faune Mamm. d'Europe, pp. 76, 77.

Type locality.—Sweden.

Geographical distribution.—Central Europe from central Scan-

* Syst. Nat., I, 10th ed., p. 46.

† Man. de Mamm., p. 144, 1827.

dinavia to northern Spain and the Mediterranean coast, westward to Great Britain; eastern limit of range not known.

Diagnosis.—Underfur buffy grey or pale buff, rarely if ever decidedly yellow.

Measurements.—Two adult males from Aberystwyth, Cardiganshire: head and body, 403 and 415; tail, 163 and 190; hind foot, 61 and 62; ear from meatus, 27 and 30. Adult female from the same locality: head and body, 360; tail, 140; hind foot, 53; ear from meatus, 23. Two adult males from Ingelheim, Rheinhessen, Germany: head and body, 400 and 440; tail, 160 and 170; hind foot, 63·6 and 65; ear from meatus, 30 and 31. Adult female from the same locality: head and body, 348; tail, 132; hind foot, 51·4; ear from meatus, 26. Adult male from Teufen, Appenzell, Switzerland (type of *manium* Barrett-Hamilton): head and body, 408; tail, 145; hind foot, 61; ear from meatus, 25. Adult male from Merse, Siena, Italy: head and body, 420; tail, 150; hind foot, 63. For cranial measurements see Table, p. 426.

Specimens examined.—Sixty-seven, from the following localities:—

Scotland: Glencassley, Sutherlandshire, 1; no exact locality, 8.

England: No exact locality, 2; Oundle, Northamptonshire, 1; Bullnose Coppice, Northamptonshire, 1; Wisbech, Cambridgeshire, 1; Swaffam Fen, Cambridgeshire, 1; Cardiganshire, 6; Aberystwyth, Cardiganshire, 6.

Sweden: No exact locality, 1 (skull; U.S.N.M.); Skåne, 1 (Stockholm).

France: Scientrier, Haute-Savoie, 2 (Mottaz).

Germany: Ingelheim, Rheinhessen, 6; Ummerstadt, Thüringen, 9; Magdeburg, Saxony, 2; Marxheim, Bavaria, 1; Niesky, Silesia, 1.

Switzerland: Teufen, Appenzell, 1 (type of *manium* Barrett-Hamilton); St. Gallen, 2; Urnäsch, St. Gallen, 1 (U.S.N.M.); Bedano, Ticino, 1 (U.S.N.M.).

Italy: Near Florence, 3 (B.M. and Mottaz); Merse, Siena, 1; Rome, 1; Viterbo, Rome, 5.

Spain: Near Burgos, 1; Palacios de la Sierra, Burgos, 1.

Remarks.—The Swiss form, to which the name *manium* has been given, appears to be identical with true *Mustela putorius*.*

♂.	Glencassley, Sutherlandshire, Scotland.	Mrs. Flower (P).	92. 10. 21. 2.
♂, ♀, 6 juv. st.	Scotland.	Purchased (Rowland Ward).	Not registered.
1.	Oundle, Northamptonshire, England.	Lord Lilford (P).	94. 6. 11. 4.
♀.	Swaffam Fen, Cambridgeshire.	R. Metcalfe (P).	11. 1. 3. 397.
♂ st.	Aberystwyth, Cardiganshire, Wales.	Hon. N. C. Rothschild (P).	0. 10. 12. 1.
♂, 2 ♀ st.	Aberystwyth.	Hon. N. C. Rothschild (P).	1. 5. 22. 5–7.

* The names *Putorius typus* F. Cuvier and *P. communis* G. Cuvier mentioned by Trouessart as synonyms of *M. putorius* I have been unable to verify.

♂, ♀.	Aberystwyth. (*Ruskin-Butterfield.*)	G. Barrett-Hamilton (P).	11. 1. 2. 105–106.
♂ skeleton.	Boneath, Cardiganshire.	W. E. de Vinton (C & P).	0. 10. 9. 1.
2.	England.	Purchased.	39. 7. 15. 2–3.
3 ♂, ♀.	Ingelheim, Rheinhessen, Germany.	C. Hilgert (C).	8. 11. 12. 18–21.
♂, ♀.	Ingelheim, Rheinhessen. (*Erlanger.*)	G. Barrett-Hamilton (P).	11. 1. 2. 107–108.
2 ♂, juv.	Ummerstadt, Thüringen. (*Schuchardt.*)	Lord Lilford (P).	11. 1. 1. 94–95.
♀.	Magdeburg, Saxony. (*Wolterstorff.*)	Lord Lilford (P).	11. 1. 1. 93. 0. 2. 8. 5.
♀.	Niesky, Silesia, Germany. (*Baer.*)	Lord Lilford (P).	97. 12. 4. 19.
♂.	Teufen, Appenzell, Switzerland. (*Zollikofer.*)	O. Thomas (P). (*Type* of *Putorius p. manium* Barrett-Hamilton.)	2. 8. 4. 24.
♂.	St. Gallen. (*Zollikofer.*)	O. Thomas (P).	4. 4. 5. 32.
♀.	Florence, Italy.	E. Cavendish Taylor (C & P).	5. 5. 6. 9.
3 ♂, 2 ♂ juv.	Viterbo, Rome. (*C. Coli.*)	G. Barrett-Hamilton (P).	11. 1. 2. 30–34.
♂ juv.	Burgos, Spain.	G. S. Miller (C).	8. 8. 4. 49.

Mustela putorius aureolus Barrett-Hamilton.

1904. *Putorius putorius aureolus* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., XIII, p. 389, May, 1904. Type in British Museum.

Type locality.—Ferrol, Province of Coruña, Spain.

Geographical distribution.—Southern and western portions of the Iberian Peninsula.

Diagnosis.—Underfur usually yellowish to extreme base, the exact shade sometimes as bright as buff-yellow.

Measurements.—Type: hind foot, 61·5; ear, 19. For cranial measurements see Table, p. 426.

Specimens examined.—Four, from the following localities in Spain: Ferrol, Coruña, 1 (type); Seville, 1; no exact locality (probably vicinity of Seville), 2.

Remarks.—The status of this form is at present very unsatisfactory. Only two specimens are known with exact localities. One of these is from the extreme north-west of Spain, the other from the neighbourhood of Seville. Together with two Spanish skins without complete history they differ from ordinary *Mustela putorius* in the conspicuously more yellow colour of the underfur. Two skins from the neighbourhood of Burgos are, however, indistinguishable from German or English specimens.

♀.	Ferrol, Coruña, Spain.	Dr. V. L. Seoane (P). (*Type* of sub-species.)	94. 3. 12. 1.
♀.	Seville. (*Dr. A. Ruiz.*)	Lord Lilford (P).	95. 3. 3. 9.
2.	Spain.	Lord Lilford (P).	94. 6. 11. 2–3.

CRANIAL MEASUREMENTS OF *MUSTELA PUTORIUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Mastoid breadth.	Interorbital breadth.	Rostral breadth over canines.	Depth of brain-case.	Palatal depth behind tooth-rows.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
M. putorius putorius.													
Sweden: no exact locality .	22394	♂	70·0	41·2	39·0	18·0	17·0	20·6	18·8	43·8	19·6	25·0	Teeth not worn.
England: no exact locality .	39. 7. 15. 3	♂	66·0	40·4	37·0	17·8	16·0	20·0	18·4	40·0	19·0	23·4	,, moderately worn.
Boneath, Cardiganshire . .	0. 10. 9. 1	♂	66·8	41·4	36·8	18·0	17·4	19·6	18·0	42·6	19·4	24·0	,, ,,
Germany: Ingelheim, Rheinhessen . .	8. 11. 2. 18	♂	71·6	43·2	38·6	19·8	17·6	20·2	18·8	45·0	19·2	25·0	,, ,,
,, ,,	8. 11. 2. 19	♂	67·6	43·2	37·8		18·0	18·8	20·8	42·8	19·6	24·6	,, slightly worn.
Ummerstadt, Thüringen . .	152668	♂	66·6	41·0	38·2	17·8	18·2	20·4	19·2	42·2	19·8	24·6	,, not worn.
Switzerland: St. Gallen .	4. 4. 5. 32	♂	68·0	41·6	36·6	18·8	17·0	19·6	18·4	42·0	18·8	23·6	,, moderately worn.
Teufen . .	2. 8. 4. 21*	♂	—	—	—	19·2	17·2	—	19·2	40·2	19·6	24·2	,, slightly worn.
Italy: Siena	152675	♂	71·8	42·4	38·2	20·0	18·2	19·2	20·2	43·2	20·2	25·4	,, moderately worn.
Sweden: Skåne . . .	Stockholm	♀	61·0	36·8	34·4	16·2	15·8	20·0	17·0	38·0	18·0	22·4	,, not worn.

England: no exact locality .	39. 7. 15. 2	♀	62·4	38·0	35·2	16·8	15·0	18·4	17·0	37·0	17·8	21·4	Teeth slightly worn.
,, ,, .	791 (U.S.N.M.)	♀	—	32·2	30·0	14·4	14·0	17·6	15·4	34·4	17·0	21·0	,, ,,
,, ,, .	792 (U.S.N.M.)	♀	61·2	35·0	31·8	14·2	13·2	17·0	16·8	37·2	18·2	21·4	,, ,,
Germany: Ingelheim, Rheinhessen . .	8. 11. 2. 21	♀	60·0	34·6	31·4	—	14·2	16·0	16·4	36·4	17·2	21·6	,, not worn.
Ummerstadt, Thüringen . .	152669	♀	58·2	32·2	31·2	14·8	13·4	17·0	15·0	34·2	16·6	20·2	,, moderately worn.
,, ,,	152670	♀	59·2	34·6	32·8	15·6	14·2	18·8	16·2	35·4	17·0	21·2	,, slightly worn.
Marxheim, Bavaria	152673	♀	62·2	36·4	34·0	15·8	15·2	17·6	16·8	38·2	18·0	22·2	,, ,,
Switzerland: Urnäsch, St. Gallen .	123629	♀	61·0	34·8	33·0	16·2	14·2	19·8	—	36·6	17·4	21·4	,, ,,
Bedano, Ticino	115214	♀	58·2	34·0	31·6	15·0	14·0	19·6	16·2	35·2	16·6	21·4	,, not worn.
Italy: near Florence . .	5. 5. 6. 9	♀	60±	36·6	32·8	16·4	14·4	—	16·4	36·6	17·6	21·2	,, slightly worn.
Spain: near Silos, Burgos .	152676	♀	61·6	37·4	34·0	16·2	15·0	19·2	17·8	37·4	17·8	21·6	,, not worn.
M. putorius aureolus.													
Spain: Ferrol . . .	94. 3. 12. 1†	♂	67·6	44·2	38·0	21·2	18·0	20·0	20·0	43·0	19·4	24·0	,, moderately worn.
Seville . . .	95. 3. 3. 9	♀	62·0	38·2	35·4	17·0	15·0	18·4	17·4	37·6	18·0	22·2	,, slightly worn.

* Type of *manium* Barrett-Hamilton. † Type.

Genus **VORMELA** W. Blasius.

1857. *Fœtorius* Blasius, Säugethiere Deutschlands, p. 219 (part).
1884. *Vormela* W. Blasius, Bericht der Naturforsch. Gesellsch. in Bemberg, XIII, p. 9.

Type species.—*Mustela sarmatica* Pallas = *M. peregusna* Gueldenstaedt.

Geographical distribution.—From south-eastern Europe to central China.

Characters.—Skull narrow, somewhat flattened (depth of brain-case a little more than half mastoid breadth), the dorsal profile slightly arched posteriorly, rather strongly bent down from orbital region forward, the zygomatic arches not specially widened, and postorbital region not unusually narrowed (distance from point of greatest narrowing to zygoma less than breadth of postorbital constriction); rostrum rather short and broad, its width about equal to that of interorbital constriction, the distance from anterior rim of orbit to gnathion equal to one-half length of brain-case; auditory bulla moderately inflated, oval or sub-triangular in outline, the meatus with a tubular rim, the anterior extremity of bulla in contact with hamular and nearly or quite reaching level of foramen ovale; dental formula: $i\frac{3\cdot3}{3\cdot3}$, $c\frac{1\cdot1}{1\cdot1}$, $pm\frac{3\cdot3}{3\cdot3}$, $m\frac{1\cdot1}{2\cdot2} = 34$; teeth relatively somewhat larger than in *Mustela*, the canines, especially those of upper jaw, relatively higher than in any of the other European *Mustelidæ*; upper carnassial robust, the width of its cutting portion about half length, the anterior cusp so developed that its greatest height is nearly three-quarters length of outer border of tooth; posterior cusp greatly reduced, appearing as a mere thickening of posterior margin of crown; inner lobe of carnassial much wider than in *Mustela*, its posterior border extending about to middle of crown; upper molar elongate-pyriform, the outer portion only a little narrower than inner, the median constriction slight, the axis of crown strongly oblique to median line; the protocone, paracone and hypocone small but distinct, the metacone barely indicated; lower carnassial essentially as in *Martes*, the metaconid small though evident, but posterior heel smaller, its area less than half that of cutting portion of crown; external form polecat-like; fur rather soft and dense, varied with black, brown, and whitish or yellowish; tail about half as long as body, bushy.

Remarks.—This strikingly characterized genus is readily distinguished from *Mustela*, apart from its peculiar external appearance, by the structure of the lower carnassial and by the relationships of the hamular, auditory bulla and foramen ovale. Two species are known, one of which ranges as far west as eastern Hungary.

VORMELA PEREGUSNA Gueldenstaedt.

1770. *Peregusna*, nova *Mustelæ* species, Gueldenstaedt, Nov. Comm. Acad. Sci. Imp. Petrop., XIV, p. 441.

1771. *Mustela sarmatica* Pallas, Reise durch verschiedene Provinzen des Russischen Reichs, I, p. 453 (along the Volga in southern Russia).

1857. *Putorius sarmaticus* Blasius, Säugethiere Deutschlands, p. 226.

1910. *Putorius sarmaticus* Trouessart, Faune Mamm. d'Europe, p. 77.

1910. *Vormela peregusna* Miller, Proc. U.S. Nat. Mus., XXXVIII, p. 385, August 19, 1910.

Type locality.—Banks of the River Don, southern Russia.

Geographical distribution.—From central Asia west through Asia Minor and southern Russia to Roumania, Bulgaria and eastern Austria-Hungary (Bukowina).

Diagnosis.—Size about as in *Mustela putorius* (head and body in an adult male, 340 mm., condylobasal length of skull about 50 mm.); auditory bulla sub-triangular in outline.

External form.—In general external characters (dry skins only examined) the animal appears to agree closely with *Mustela putorius*, except that the ear is relatively larger, the tail is more bushy and less tapering, occasionally appearing somewhat flattened, and the claws on front foot are more slender and compressed. Soles and palms thickly furred except on the pads, all of which are naked; palm with two posterior tubercles, the outer somewhat smaller than in *M. putorius*, the inner about half as large as outer. Mammæ: *a* 4–4, *i* 2–2 = 12.

Colour.—Ground colour of upper parts raw-umber, most of the hairs with darker tip and lighter subterminal band, a few blackish throughout, the combination producing a slight effect of variegation. Spots varying from a whitish buff to buff-yellow, and arranged as follows: a large spot covering base of tail and extending slightly on rump (often partly divided by a dark streak along middle); a broad stripe extending obliquely downward from middle of shoulder across side of body, and separated from its fellow in median line above by a brown, irregularly defined, or interrupted line; about thirty-five small spots in region between shoulder stripes and base of tail, their boundaries indistinct and tending to coalesce into transverse bands, their total combined area slightly less than that of brown background; a stripe extending from back of ear along side of neck nearly to shoulder; several small ill-defined spots on back of neck tending to form a median longitudinal stripe; underfur in dark area a slaty-drab, in light areas similar to long hairs but paler, so that the colour pattern becomes more sharply defined on areas where the fur has been nearly worn off. Head, feet, legs and underparts varying from dark seal-brown to black. Lips and interramia whitish or buffy. A broad white or buffy crescent crosses forehead above eyes and extends downward and backward to sides of throat behind ears. Dark crown area emphasized by a

suffusion of whitish behind it. Ear white or buffy except at extreme base, which is blackish. Tail black at tip, elsewhere white set off by underlying black; the individual hairs cream-colour through basal third, then darkening rapidly through raw-umber to black, the terminal third white.

Skull.—The skull is smaller than that of *Mustela putorius*, though resembling it in its general strength and massiveness,

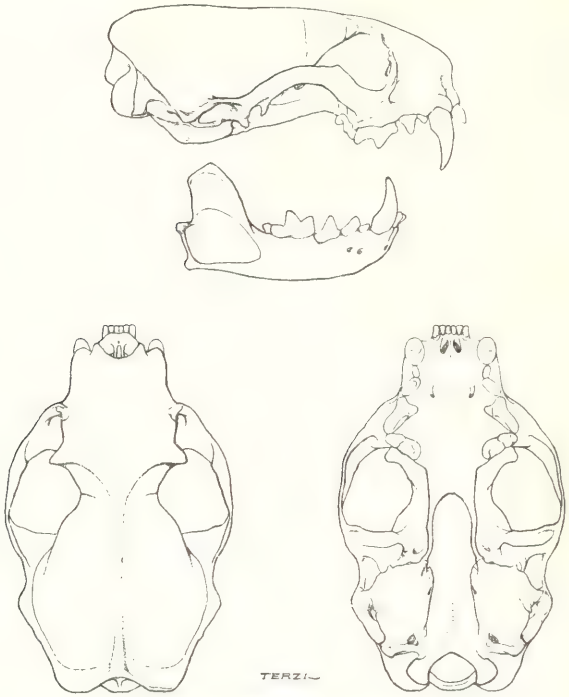

FIG. 86.
Vormela peregusna. Nat. size.

particularly in lateral view. Dorsal profile almost exactly as in *Mustela putorius*, flat from level of anterior portion of orbit to occipital region, the rostrum bent downward at an evident angle. Depth of rostrum relatively great, as in *M. putorius*, and noticeably exceeding that of *Mustela erminea*. Postorbital constriction abrupt, as in *Mustela eversmanni*, giving the skull when viewed from above a very peculiar aspect as compared with that of

CRANIAL MEASUREMENTS OF *VORMELA PEREGUSNA*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital breadth.	Breadth of rostrum over canine.	Mastoid breadth.	Occipital depth.	Palatal depth behind tooth-rows.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
Baluchistan . .	69. 8. 24. 1	♀	54·2	31·8	15·0	13·6	28·8	15·6	14·2	33·6	16·4	20·2	Teeth slightly worn.
Candahar . .	79. 11. 21. 493		52·8	31·8	13·8	14·0	28·8	16·8	14·6	34·8	15·8	21·2	,, not worn.
,, . .	79. 11. 21. 494		50·4	30·2	12·4	13·2	26·8	15·8	14·2	32·2	15·2	20·0	,, ,,
Roumania: Malcoci, Dobrudscha	10. 6. 4. 1	♂	53·2	33·8	16·2	14·2	29·2	17·4	15·8	34·6	16·8	20·2	,, slightly worn.
,, ,, .	154925	♀ (juv.)	52·4	31·6	—	14·0	29·6	17·2	15·6	33·0	15·8	22·0	Nasal sutures open.
,, ,, .	154926	♀ (ad.)	53·4	33·0	—	14·6	31·0	17·0	16·2	34·8	16·6	22·0	Teeth slightly worn.

M. putorius. In fully adult individuals the postorbital breadth is noticeably less than that of rostrum or interorbital region. Viewed from below the most striking feature in general outline of skull is the shallowness of the emargination between mastoid process and base of zygoma. Tip of hamular in contact with bulla, a peculiarity due principally to the general shifting forward of bulla with regard to glenoid region.

Teeth.—As compared with those of *Mustela putorius* and *Mustela erminea* the teeth are throughout relatively heavier and the cusps more elongated. Height of upper canine slightly more than depth of rostrum, instead of decidedly less than rostral depth as in *Mustela putorius*. Upper carnassial with broader antero-internal projection than in *M. putorius*, and upper molar set more obliquely to main axis of skull. Lower carnassial strikingly different from that of all species of *Mustela* in the presence of a well developed third cusp on anterior elevated portion of tooth, the form of which is thus essentially as in the martens. Interrelationships of small premolars much as in *Mustela putorius*.

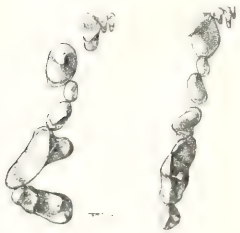

FIG. 87.

Vormela peregusna. Teeth. × 1½.

Measurements.—Adult male and female from Malcoci, Dobrudscha, Roumania (from well-made skins): head and body, 380 and 350; tail, 160 and 160; hind foot, 45 and 40; ear, 25 and 23. For cranial measurements see Table, p. 431.

Specimens examined.—Three, from the neighbourhood of Malcoci, Dobrudscha, Roumania (B.M. and U.S.N.M.); also others from various localities in Asia.

Remarks.—*Vormela peregusna* is so well characterized both cranially, dentally and externally as to require no detailed comparison with other European carnivores.

♂.	Malcoci, Dobrudscha, Roumania. (*Schlüter.*)	Hon. N. C. Rothschild (P).	10. 6. 4. 1.

SUB-FAMILY GULONINÆ.

Geographical distribution. Northern forested portions of the Northern Hemisphere.

Characters.—Dentition essentially as in the *Mustelinæ* but much less trenchant, the small premolars opposite and not capable of shearing action, the points of all but pm^3 and pm_4 widely separated when jaws are closed; upper carnassial very robust, its posterior cusp broad, almost flat-topped, its height much more

than half that of main cusp; skull robust and heavy; external form heavy, not in the least cat-like; feet sub-plantigrade.

Remarks.—The sub-family *Guloninæ*, consisting of the genus *Gulo* alone, is well characterized by its peculiarities of skull, teeth and external form. Though usually regarded as a near relative of the *Mustelinæ*, the genus more probably finds its true affinities in the African *Mellivora*.

Genus **GULO** Storr.

1780. *Gulo* Storr, Prodr. Meth. Mamm., p. 34.
1857. *Gulo* Blasius, Säugethiere Deutschlands, p. 208.

Type species.—*Mustela gulo* Linnæus.

Geographical distribution.—Northern forests of the Northern Hemisphere; in Europe confined to Scandinavia and northern Russia.

Characters.—Skull heavily built, rather narrow but not so high as in *Martes* (depth of brain-case slightly more than half mastoid breadth), the dorsal profile strongly curved downward anteriorly, the zygomatic arches not specially widened, and postorbital region not unusually narrowed (distance from point of greatest narrowing to zygoma less than breadth of postorbital constriction); rostrum short and very robust, its width about equal to that of interorbital region, the distance from rim of orbit to gnathion about two-thirds length of brain-case; auditory bulla inflated along inner border, elsewhere rather flat, the meatus forming an ill-defined, gradually narrowing tube, the transverse diameter of bulla greatest; paroccipital process robust, long, standing out conspicuously behind bulla; dental formula: $i\frac{3\,3}{3\,3}$, $c\frac{1\text{-}1}{1\text{-}1}$, $pm\frac{4\,4}{4\text{-}4}$, $m\frac{1\text{-}1}{2\,2} = 38$; teeth relatively lower, wider and more robust than in *Mustela* (their actual size conspicuously greater); small premolars almost directly opposed, not fitting between each other when jaws are shut, and only pm^3 and pm_4 capable of being brought in contact; lower carnassial with crown wider anteriorly than posteriorly, the metaconid absent, the area of posterior heel only about one-fifth that of cutting portion of crown; external form short and heavy, almost bear-like, the head moderately pointed, the ears small, nearly concealed by the fur, the tail very short, not so long as head, densely bushy with hairs much longer than itself; legs short, feet large, digitigrade, the moderately long claws partly retractile; fur long, soft and dense.

Remarks.—The genus *Gulo* is represented by two closely related species, *G. luscus* of the northern portions of America, and *G. gulo* of the Old World.

GULO GULO Linnæus

1758. [*Mustela*] *gulo* Linnæus, Syst. Nat., I, 10th ed., p. 45.
1816. *Gulo vulgaris* Oken, Lehrbuch d. Naturgesch., III, pt. 2, p. 1004 (Renaming of *gulo*).
1820. *Gulo borealis* Nilsson, Skand. Faun., I, p. 95 (Renaming of *gulo*).
1820. *Gulo arcticus* Desmarest, Mammalogie, p. 174 (Renaming of *gulo*).
1829. *Gulo arctos* Kaup, Entw.-Gesch. u. Natürl. Syst. Europ. Thierw., I, p. 68, described on p. 69 (Renaming of *gulo*).
1857. *Gulo borealis* Blasius, Säugethiere Deutschlands, p. 209.
1910. *Gulo luscus* Trouessart, Faune Mamm. d'Europe, p. 71. Not *Ursus luscus* Linnæus, 1758.
1911. *Gulo gulo* Collett, Norges Pattedyr, p. 326.

Type locality.—Lapland.

Geographical distribution.—Northern forests of the Old World; in Europe, confined to Scandinavia and northern Russia.

Diagnosis.—Largest of the European *Mustelidæ* (head and body, about 800 mm.; condylobasal length of skull, about 130 to 140); general colour dark brown with a lighter crescent on forehead and another lighter area crossing rump and extending along sides of body toward front legs.

External characters.—General form heavy, badger-like, the apparent size of the animal as well as its shortness of limb exaggerated by the great depth and peculiar quality of the fur. Head short and thick; ears densely haired both inside and out, low and rounded, fully as wide as high, not appearing conspicuously above fur; muzzle pad well defined, naked, the bare region extending downward to region where upper lip folds inward (the infolded portion of lip hairy). Feet broad and strong, the sole and palm each with three naked or almost naked pads, which are wholly concealed in winter by the dense growth of long hairs with which the feet are elsewhere covered, though in the summer pelage they may be partly exposed; claws strong, not completely retractile, those on hind foot slightly the longer. Tail short, the vertebræ scarcely equal to hind foot, the entire tail covered with long hairs, so as to form a dense brush, the hairs at tip 70 to 140 mm. in length, according to season, and often as long as vertebræ. Fur of a peculiar and characteristic quality; underfur soft and dense, its hairs 20 to 30 mm. long on back according to season; longer hairs rather coarse and very numerous, their length about 50 mm. on back, but increasing abruptly to twice as long on flanks and rump, thus adding greatly to the heavy appearance of the animal; long hairs on wrist and sides of fore foot tending to become almost bristle-like in texture.

Colour. Upper parts and belly a rich dark brown becoming blackish on legs, feet and tail; a broad light (wood-brown) stripe crosses rump and extreme base of upper side of tail and curves forward along sides to axillary region where it gradually disappears; crown to and partly including ears, and face to

between eyes, suffused with cream-buff, so that this region is paler than any other part of the animal; muzzle and cheek to and surrounding eye in a stripe about 10 mm. wide, dark brown; claws light horn-colour.

Skull.—The skull is larger and more massive than in any of the other European *Mustelidæ*, its general form somewhat intermediate between that of *Meles* and *Martes*. Dorsal profile with slight anterior concavity over middle of short nasals, then rather

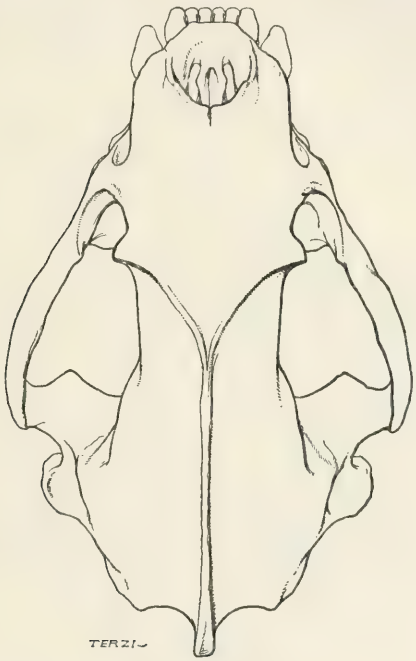

FIG. 88.
Gulo gulo. Reduced.

strongly convex to bregmal region, behind which it is straight and nearly horizontal to distinctly overhanging lambda. Brain-case elongate-ovate in outline when viewed from above, about $1\frac{1}{4}$ times as wide as deep, the sagittal crest moderately developed in old individuals and joining rather low lambdoid crests in a noticeably backward projecting point, the entire occipital region sufficiently overhanging to conceal condyles when viewed from above. Floor of brain-case with no special peculiarities, the basioccipital essentially as in *Martes martes* but relatively wider.

Auditory bullæ inflated along inner border, elsewhere rather flat, their general form elongate flask-shaped (transverse diameter greatest), much like that in *Meles meles*, the meatal tube rather long but not sharply differentiated from main portion of bulla. Postorbital region less abruptly contracted than in *Meles meles* and *Martes martes*, its width slightly more than half that of brain-case. Interorbital region about as wide as rostrum, smoothly convex both longitudinally and laterally. Postorbital processes short but relatively better developed than in *Martes*. Rostrum short and heavy, the width across canines equal to distance from gnathion to infraorbital foramen. Orifice of

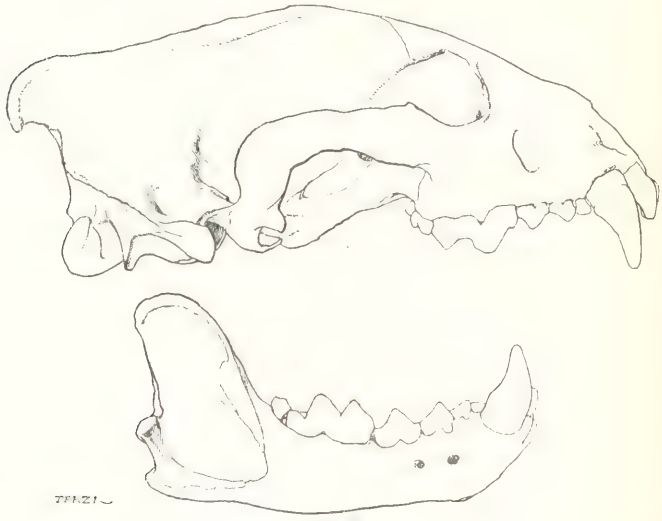

FIG. 89.
Gulo gulo. Reduced.

anteorbital foramen relatively small, its actual size scarcely greater than that in *Martes martes*, its situation over posterior root of pm^3 and noticeably in front of anterior margin of rather small orbit, a peculiarity not shared by any of the other European members of the family. Zygomata essentially as in *Martes martes*, but less bowed upward, and very noticeably compressed and deepened, especially over glenoid region. Palate rather broad, its width between molars equal to nearly $2\frac{1}{2}$ times greatest diameter of molar; incisive foramina elliptical, slightly oblique, between canines, the minute median foramen between anterior borders; posterior extension and mesopterygoid space essentially

as in *Martes*. Mandible very robust and massive, but with no special peculiarities of form. It is distinguishable from that of *Meles meles*, which approaches it in size, by the deeper, more compressed ramus and relatively higher coronoid process.

Teeth.—Except for their much greater size the incisors and canines resemble those of *Martes martes*. Small premolars both above and below with crowns relatively lower and broader than in *Martes*, and less distinctly triangular when viewed from the

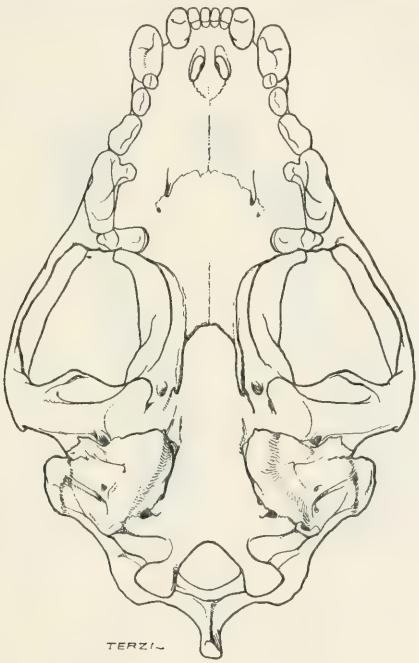

FIG. 90.
Gulo gulo. Reduced.

side, the teeth of the upper and lower jaws almost directly opposed and not fitting between each other when jaws are closed, the tips of pm^3 and pm_4 barely coming in contact, those of the other teeth separated by a wide space; pm_4 with slightly raised cingulum at posterior border, but without trace of the secondary cusp present in *Martes*. Upper carnassial like that of *Martes* in general outline, but posterior cusp relatively much larger, its height distinctly more than half that of main cusp, its outer

surface at first nearly flat, then sloping almost perpendicularly to very rudimentary cingulum; commissure relatively shorter than in *Martes*. Lower carnassial slightly more than twice as long as broad, the sectorial portion of the tooth consisting of two equally robust cusps, the lower the paraconid, whose anterior border slopes backward at an angle of about 50°, and the higher the protoconid, the two connected by an abruptly angled commissure. No trace of metaconid other than a barely noticeable thickening in the ridge which extends from apex of protoconid downward along inner side of cusp to cingulum; a similar ridge at outer side of protoconid and across posterior heel slightly external to

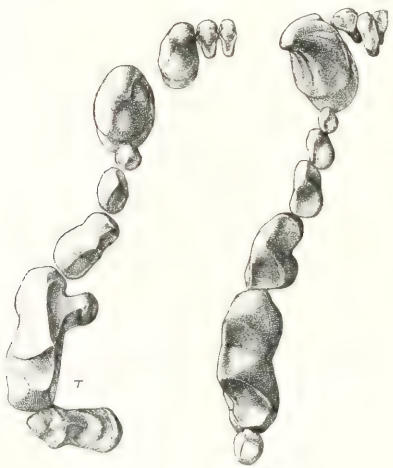

FIG. 91.

Galogale. Teeth. Nat. size.

middle. Crushing portion of crown reduced to a mere ledge much wider than long and with scarcely half the area of base of protoconid; a faintly indicated outer tubercle. Second lower molar subterete, flat, with faintly developed cusp and longitudinal and transverse cross ridges, its crown area about equal to that of pm_2, and a little larger than that of posterior heel of m_1. Upper molar relatively small, its crown area scarcely more than half that of carnassial, its greatest diameter about two-thirds that of carnassial; diameter of inner portion of crown slightly greater than that of outer portion, the constriction between the two portions not well defined; cusps essentially as in *Martes martes*, but paracone and metacone tending to become confluent.

CRANIAL MEASUREMENTS OF *GULO GULO*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Mastoid breadth.	Interorbital breadth.	Rostral breadth over canines.	Occipital depth (crest excluded).	Palatal depth behind tooth-row.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Upper carnassial.	Lower carnassial.	Observations.
Norway: Vaage	Genoa	♀	136	91·0	76·6	37·0	35·4	44·0	36	96·4	48·0	57	19·4 × 10·8	20·0 × 9·0	Teeth not worn.
Egersund	10. 11. 26. 1.	♂	147	102·7	85·6	41·0	39·5	44·0	—	101·0	52·5	66	20·5 × 12·0	21·3 × 9·2	,, worn.
,,	11. 10. 23. 1.	♀	135	93·0	74·0	38·0	36·5	43·0	—	96·0	51·0	63	19·0 × 11·2	20·0 × 8·8	,, ,,
Lapland . .	1041 (U.S.N.M.)	♀ ?	133	85·0	76·0	36·0	35·6	43·2	40	93·6	48·4	57	18·0 × 11·0	19·2 × 8·6	,, slightly worn.
Sweden . .	22292	♂ ?	141	95·6	81·0	38·4	38·0	42·0	39	100·0	50·4	60	19·0 × 11·2	19·2 × 8·8	,, ,,

Measurements.—Adult (summer pelage) from Sweden (from skin): head and body, 825; tail, 125 (pencil, 75); hind foot, 140±. For cranial measurements see Table, p. 439.

Specimens examined.—Six, from the following localities:—
NORWAY: Vaage, Gudbrandsdal, 1 (Genoa); Egersund, Stavanger, 1 skeleton and 1 skull.
SWEDEN: Fråstvik, 1; no exact locality, 1 skull (U.S.N.M.).
LAPLAND: No exact locality, 1 skull (U.S.N.M.).

♂ skeleton, Egersund, Norway. K. H. Schaanning (c). {10. 11. 26. 1.
♀ skull. {11. 10. 23. 1.

FAMILY VIVERRIDÆ.

1821. *Viverridæ* Gray, London Med. Repos., XV, p. 301, April 1, 1821.

Geographical distribution.—Warmer portions of the Old World (exclusive of Australia); north to the Iberian Peninsula and southern France.

Characters.—Dentition essentially as in the *Mustelidæ*, but upper molars usually 2–2, and upper carnassial usually with three outer cusps; auditory bulla, when not rudimentary (1 African genus), inflated, thin-walled, divided by a distinct septum into two chambers; form usually rather slender, the legs moderately short; size moderate; feet digitigrade.

Remarks.—The family *Viverridæ* is a tropical Old World group, containing about 25 genera, the ranges of two of which extend into the Mediterranean region of Europe.

KEY TO THE EUROPEAN GENERA OF *VIVERRIDÆ*.

General form ferret-like; ear broader than high; body and tail uniformly grizzled; bony palate extending behind molars in median line about half distance to hamulars; orbit nearly or quite enclosed by bone posteriorly (Mongoose)..... *Mungos*, p. 440.

General form cat-like; ear higher than wide; body spotted; tail ringed; bony palate extending behind molars in median line much less than half distance to hamulars; orbit widely opening into temporal fossa (Genet)..... *Genetta*, p. 446.

Genus **MUNGOS** Geoffroy and Cuvier.

1795. *Mungos* Geoffroy and Cuvier, Magasin Encyclopédique, II, p. 187 (*mungo*, p. 184).
1811. *Herpestes* Illiger, Prodr. Syst. Mamm. et Avium, p. 135 (misspelt *Herpertes* in text, corrected in list of errata, p. 302) (*ichneumon*).
1824. *Mangusta* Horsfield, Zool. Researches in Java (*javanica*).
1830. *Martes* Wagler, Nat. Syst. der Amphibien, p. 29 (Substitute for *Herpestes* Illiger, preoccupied in botany). Not of Pinel, 1792.
1842. *Mungo* Lesson, Nouv. Tabl. Règne Anim., Mamm., p. 63 (*ichneumon*).
1907. *Mungos* Thomas, Ann. and Mag. Nat. Hist., 7th ser., XIX, p. 119, January, 1907.

Type species.—*Viverra mungo* Gmelin.
Geographical distribution.—Africa, southern Asia, and larger

Malayan Islands; in the Mediterranean region one species inhabits the Iberian Peninsula.

Characters.—External form ferret-like; the ear low and wide; the tail broad and flattened at base, tapering conspicuously through terminal half, the fur coarse, grizzled; soles and palms naked; claws long, non-retractile; skull robust, deepened anteriorly; orbit small, nearly or quite surrounded by bone; backward median extension of palate long; auditory bulla complete, its two divisions conspicuously contrasted in size and form; dental formula: $i\frac{3}{3}\frac{3}{3}$, $c\frac{1}{1}\frac{1}{1}$, $pm\frac{4}{4}\frac{4}{4}$, $m\frac{2}{2}\frac{2}{2} = 40$; cheek-teeth trenchant.

Remarks.—The widely dispersed genus *Mungos*, which is one of the most characteristic features of the carnivorous fauna of Africa and southern Asia, where about 60 forms have been discovered, is unknown in Europe outside of the Iberian Peninsula.

MUNGOS WIDDRINGTONII Gray.

1842. *Herpestes widdringtonii* Gray, Ann. and Mag. Nat. Hist., 1st ser., IX, p. 50, March, 1842. Type in British Museum.

1909. *Herpestes ichneumon* var. *ferruginea* Seabra, Bull. Soc. Portugaise Sci. Nat., II, p. 286, May, 1909 (Altemejo, Portugal).

1909. *Herpestes ichneumon* var. *dorsalis* Seabra, Bull. Soc. Portugaise Sci. Nat., II, p. 286, May, 1909 (Ribatejo, Portugal).

1909. *Herpestes ichneumon* var. *grisea* Seabra, Bull. Soc. Portugaise Sci. Nat., II, p. 286, May, 1909 (Ribatejo, Portugal).

1910. *Herpestes ichneumon widdringtoni* Trouessart, Faune Mamm. d'Europe, p. 89.

Type locality.—Sierra Morena, Spain.

Geographical distribution.—Iberian Peninsula, principally in the south; exact limits of range not known.

Diagnosis.—Similar to the African *Mungos ichneumon*, but with larger carnassial teeth (greatest diameter of upper carnassial about 11·8 instead of 10·8 in males, 11·2 instead of 10·2 in females), and more inflated auditory bullæ (lateral diameter of swollen portion about 12 mm. instead of 10 mm.).

External characters.—General form slender and ferret-like, the conspicuously tapering tail about as long as body without head, the legs short, the head rather small and pointed, the ear low and rounded, the fur remarkably coarse and harsh. Ear scarcely rising above fur, its width decidedly greater than height from meatus, its outline evenly rounded. Rostrum slender, tapering, the nostril pad entirely naked, its surface nearly smooth, the bare area extending downward as a narrow line across middle of upper lip; region from muzzle to and immediately surrounding eye very scantily haired, in some specimens almost bare; upper eyelid with a fringe of erect black hairs about 5 mm. long; whiskers short and inconspicuous, scarcely extending beyond eye when laid backward. Feet rather large

and elongate, with long, non-retractile claws, those on front feet longest; hallux and pollex short but with well developed claw more than half as large as those on other digits; sole and palm completely naked, the sole with a heart-shaped tubercular mass about 15 mm. wide occupying region immediately behind bases of digits, the palm with a similar mass at base of fingers, and an isolated roundish median posterior tubercle about 8 mm. in diameter. Fur with dense somewhat woolly under portion, the hairs of which are about 20 mm. long, and a very abundant growth of coarse almost bristly longer hairs (these essentially absent along entire median region of underparts), whose length is about 50 mm. at middle of back, increasing to 75 mm. on flanks, rump, and base of tail; near middle of tail the length of the longer hairs decreases rather abruptly to about 50 mm., the hairs at the same time becoming somewhat appressed, thus giving the tail its characteristic tapering form; pencil long and full. Mammæ: *a* 2–2 = 4.

Colour.—The colour does not differ appreciably from that of Moroccan and Egyptian specimens of *Mungos ichneumon*. Head, back, sides and tail (except the clear black tip) a coarse grizzle of blackish and pale buff, each hair on body and tail buff at base and with three buff annulations 3 to 5 mm. in length interposed between the blackish tip (5 mm.) and the three blackish intervening areas, the length of which varies from 6 to 10 mm. Underfur dull tawny, the hairs slaty at base, the tawny appearing everywhere irregularly at surface, though mostly overlaid by the annulated bristly hairs. On body and tail the black and buff are about equally noticeable, but on head the annulations become much finer and the dark colour predominates, often appearing as a clear blackish brown wash on face and muzzle. Ears a light indefinite grizzled brown, somewhat paler than the broccoli-brown of Ridgway. Underparts from chin to base of tail a dark brown slightly or not grizzled, the exact shade varying from a dark hair-brown to broccoli-brown. This extends down inner side of hind legs to feet, where it becomes nearly black, and involves entire fore leg except the uppermost outer portion. On fore feet and outer portion of leg below elbow it becomes blackish.

Skull.—The skull is narrow and rather high, mastoid breadth less than occipital depth including bullæ, with deep short rostrum (depth at front of orbit greater than distance from orbit to tip of premaxillary) and small orbit (vertical diameter less than depth of rostrum at canine) completely encircled by bone in the adult and with the circular form always clearly indicated by the long drooping postorbital process and the distinct orbital process of the zygoma rising to meet it. Anteorbital foramen small, higher than wide, over space between pm^2 and pm^3. Median backward prolongation of palate conspicuous, extending rather more than half way to hamulars, its posterior border squarely truncate

or irregularly angular-emarginate, never with median projection ; mesopterygoid space much less than twice as long as broad, parallel-sided ; hamulars robust, the thickened extremities bent

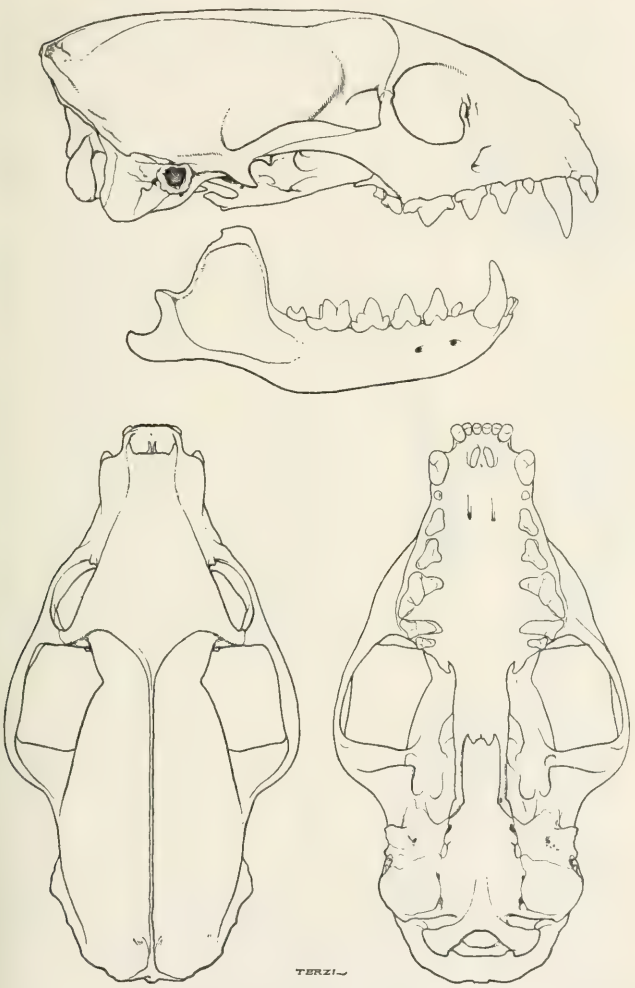

FIG. 92.

Mungos widdringtonii. Reduced.

abruptly upward. Auditory bulla with anterior annular portion small and flattened, the small meatus with short but evident tube marked off from ring by a constriction; posterior inflated part of bulla large, higher than wide, extending noticeably below level of palate, and projecting laterally beyond mastoid level; greatest transverse diameter of inflated portion about equal to least breadth of basioccipital. Paroccipital process long, narrow and scale-like, closely flattened against posterior surface of bulla, less than half of which it covers. Lambdoid and sagittal crests well developed, the latter extending across entire brain-case to postorbital region. Mandible robust, the lower border bent abruptly upward at level of m_3; coronoid process short and broad, its width at level of condyle much greater than height above condyle.

Teeth.—The teeth are robust and strong but not remarkably large. Incisors and canines with no special peculiarities, the cutting edge of upper incisors entire, that of lower incisors obscurely bilobed, the outer lobe largest. Anterior premolar both above and below simple, smaller than corresponding outer incisor. Second and third premolars triangular when viewed from side, the two upper teeth without true secondary cusps, but pm^3 sometimes with a slightly developed posterior basal tubercle; inner median projection well developed and bearing a small cusp in pm^3, slightly indicated in pm^2; the two lower teeth with longer base and less robust main cusp, pm_3 with slightly developed anterior basal cusp and a small but distinct median cusp on posterior cutting edge. Fourth lower premolar like second and third but larger, the crown wider behind and the cusp on posterior cutting edge large and well developed. Upper carnassial with large antero-internal lobe somewhat exceeding posterior heel in area, its cusp robust; antero-external corner with large, occasionally almost cusp-like cingulum; anterior border of tooth slightly concave. Lower carnassial with the three anterior cusps large, the outer exceeding the two inner, which are of approximately equal height, the posterior heel low, its area barely half that of anterior portion of tooth and about equal to that of second molar, its postero-external border elevated and trenchant. First upper molar with crown nearly twice as wide as long, its anterior border convex, its outer and posterior borders concave; protocone large, occupying entire inner border of crown; paracone and metacone small, sub-equal, the latter

FIG. 93.

Mungos wildringtoni. Teeth. Nat. size.

CRANIAL MEASUREMENTS OF *MUNGOS WIDDRINGTONII* AND *M. ICHNEUMON*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Mastoid breadth.	Postorbital constriction.	Interorbital constriction.	Breadth of rostrum over canines.	Occipital depth.	Palatal depth behind tooth-rows.	Depth of rostrum behind canines.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
M. widdringtonii.															
Spain: Ferrol, Coruña	94. 11. 3. 1	♂ juv.	—	48·0	34·0	18·6	16·0	17·0	31·6	28·4	14·8	58·0	35·0	37·0	Teeth not worn.
Sierra Morena	42. 2. 26. 2*	♂	—	—	—	—	19·2	20·4	—	—	17·0	—	35·0	—	,, worn.
Seville . .	95. 9. 4. 5	♂ juv.	98·0	54·0	35·4	20·8	19·8	18·8	32·0	28·0	16·0	64·8	35·4	40·0	,, not worn.
,, . .	95. 9. 4. 6	♀	105·0	—	40·0	19·0	—	21·4	33·0	31·0	19·0	70·4	37·8	42·0	,, moderately worn.
Coto Doñana, Huelva .	10. 7. 14. 1	♂	103·0	57·2	39·2	20·8	21·2	21·4	—	34·2	17·4	68·2	36·8	42·0	,, slightly worn.
M. ichneumon.															
Morocco: near Tangier	362 B.H.	♂	99·0	53·4	35·0	—	—	19·8	33·0	29·8	18·0	65·0	37·0	40·4	
,,	363 ,,	♂	94·6	50·4	36·0	—	—	18·4	32·0	28·0	16·0	62·6	34·6	38·0	

* Type.

occupying postero-external corner of crown, the former exceeded by the large low parastyle, the basal area of which is nearly equal to that of protocone. Second upper molar with crown area only about one-third that of first, its antero-external extremity fitting into convexity behind metacone of m^1; in general structure it is like m^1 except that the projecting parastyle is absent and the paracone and metacone are less distinct. Second lower molar with crown slightly longer than wide, somewhat exceeding the heel of m_1 in height, its borders sometimes with four distinct cusps, the two on inner side largest, but more often with postero-external and postero-internal cusps partly confluent.

Measurements.—Type (adult male): hind foot, 95; ear from meatus, 34·5. Immature male and adult female from Seville: head and body, 530 and 510; tail, 430 and 330; hind foot, 90 and 87. Adult male from Coto Doñana, Huelva (from skin): head and body, 550; tail, 450; hind foot, 95·5. Immature male from Ferrol, Coruña; hind foot, 86.

Specimens examined.—Eight, from the following localities in Spain: Ferrol, Coruña, 1; Sierra Morena, 1 (type); Seville, 3; Coto Doñana, Huelva, 1; Andalucia, no exact locality, 2.

Remarks. Among the smaller carnivores of Europe *Mungos widdringtonii* is recognizable by its conspicuously grizzled colouration and long, coarsely-haired, tapering tail. It is nearly related to the African *M. ichneumon*, though sufficiently distinguished by its larger teeth.

♂.	Ferrol, Coruña, Spain.	Dr. V. L. Seoane (C & P).	94. 11. 3. 1.
♂	Sierra Morena.	Capt. S. E. Widdrington (P). (*Type* of species.)	42. 2. 26. 2.
♂, ♀.	Seville. (*Dr. A. Ruiz.*)	Lord Lilford (P).	95. 9. 4. 5–6.
skull.	Seville.	Col. Irby (C & P).	85. 9. 1. 1.
♂.	Coto Doñana, Huelva.	A. Chapman (C & P).	10. 7. 14. 1.
ad & juv.	Andalucia.	Lord Lilford (P).	78. 7. 3. 2–3.

Genus **GENETTA** Oken.

1816. *Genetta* Oken, Lehrb. der Naturgesch., III, pt. 2, p. 1010 (*genetta*).
1841. *Odmalurus* Gloger, Gemeinn. Hand- u Hilfsbuch der Naturgesch., I, p. 72 (*genetta*).

Type species.—*Viverra genetta* Linnæus.

Geographical distribution.—Africa and Mediterranean region of Europe.

Characters.—External form cat-like, the ear narrow and high, the tail subterete, not conspicuously tapering, ringed with dark and light bands, fur soft, spotted with black on a light ground; soles and palms densely furred except on pads; claws short, retractile; skull slender, not specially deepened; orbit large, opening widely into temporal fossa; backward median extension

of palate short; auditory bulla complete, its two divisions not strongly contrasted in size and form; dental formula: $i\frac{3-3}{3-3}$, $c\frac{1-1}{1-1}$, $pm\frac{4-4}{4-4}$, $m\frac{2-2}{2-2} = 40$; cheek-teeth trenchant.

Remarks.—The genus *Genetta*, though practically confined to Africa, extends its range into the Mediterranean region of Europe, chiefly in Spain and the western portion of France. Many local forms have been described, the status of which is imperfectly understood. Three of these appear, on the basis of the insufficient material seen, to be recognizable in Europe.

KEY TO THE EUROPEAN FORMS OF *GENETTA GENETTA*.

Spots in first three rows at side of dorsal stripe tending to be confluent, and occupying more space than light ground-colour in same region (Southern France) ..... *G. g. rhodanica*, p. 452.

Spots in first three rows at side of dorsal stripe tending to be distinct, and occupying less space than light ground-colour in same region.

Ground-colour of back a buffy grey; largest spots about 20 mm. in diameter (Central and southern Spain)..... *G. g. genetta*, p. 451.

Ground-colour of back a smoky grey; largest spots about 30 mm. in diameter (Balearic Islands)... *G. g. balearica*, p. 452.

GENETTA GENETTA Linnæus.

(Synonymy under subspecies.)

Geographical distribution. — Iberian Peninsula, Balearic Islands, and central France, north to Department of the Eure, east to the valley of the Rhone; probably in western Africa also; limits of range not known.

Diagnosis.—General characters as in the genus; size moderate (head and body, about 550; tail, about 450; condylobasal length of skull, about 90 mm.); colour light grey with black spots arranged in longitudinal rows, the spots not tending to run together except on back; tail with distinct alternating rings of black and light grey.

External characters.—General form cat-like but rather more slender, the tail about as long as body without head, the legs moderately long, the ear large, higher than wide, the fur fine and soft. Head moderately tapering, the muzzle somewhat pointed; ear rising conspicuously above fur, its general outline oval, the upper border evenly rounded off, the anterior border with a projecting basal angle, the posterior border with an angular emargination somewhat below middle, the emargination covered by a small rounded lobe arising from outer surface of ear. Muzzle pad entirely naked, its surface finely granular, the bare area extending downward as a narrow line dividing middle of upper lip; whiskers well developed, reaching beyond base of ear when laid back. Feet cat-like, the digits short, armed with

retractile claws, those of hind foot slightly the larger; sole, palm, and under surface of digits velvety-furred except on balls of toes and surface of tubercles; palm with large, cordate, obscurely 3-lobed tubercular mass at base of longer digits, a small roundish pad at base of thumb, and two semi-confluent, elongate pads, the outer nearly twice as large as inner, at posterior margin of palm; sole with similar trilobed mass at base of longer digits, an elongate pad at base of hallux, and a linear-elongate pad on outer side of sole, partly divided into two by longitudinal furrow, and extending from level of base of hallux more than half way to heel. Fur not peculiar in quality, the underfur dense, its hairs about 25 mm. in length on back, the longer hairs soft, exceeding the underfur by about 5 to 10 mm.; hairs on tail somewhat longer than those of body, about 50 mm. at middle, rather more at base and less at tip. Mammæ: a 2–2 = 4.

Colour.—Ground colour throughout a light grey, with or without an evident buffy or brownish tinge, the slaty bases of the hairs sometimes appearing at surface, particularly on underparts. Back and sides thickly spotted with black, the spots always confluent along median line, where they form a narrow stripe extending from shoulders to base of tail, those on sides arranged in four or five longitudinal rows, of which the two uppermost on each side usually show some tendency to run together into stripes, while the lower ones are more widely spaced; when not crowded the spots are sharply and evenly outlined, roundish or somewhat longer than broad, the diameter of largest about 30 mm. Neck with narrow well-defined lateral black stripe and one or two less sharply marked median stripes. Base of ear black, the terminal half grey. Cheek and face grey, with ill-defined median dark streak and faint supraorbital shade; muzzle with conspicuous blackish area at base of whiskers and extending back to eye, the extreme anterior region at side of pad and beneath it sharply contrasted light grey. Feet grey above with a few small black spots, the under surface blackish except for lighter region between pads; black of hind foot extending upward to cover much of inner surface of thigh. Tail ringed with black and light grey, the extreme base light, the tip either light or dark, the rings about equally wide throughout, their number 8 to 10 of each colour; black rings tending to run together along median line above on basal third of tail.

Skull.—The skull is not unlike that of *Herpestes widdringtonii* in general form, though much less robust, not unusually deepened, the orbit large, widely open posteriorly, its vertical diameter greater than depth of rostrum at canine, the auditory bullæ not much inflated; mastoid breadth about equal to occipital depth including bullæ; depth of rostrum at front of orbit considerably less than distance from orbit to tip of premaxillary; postorbital processes short, not produced downward, no orbital process of zygoma, the large orbit thus opening

widely into temporal fossa ; anteorbital foramen moderately large, slightly higher than wide, over middle of pm^4; median backward prolongation of palate short, extending about 3 mm. behind level of last molar, its posterior border double concave, with

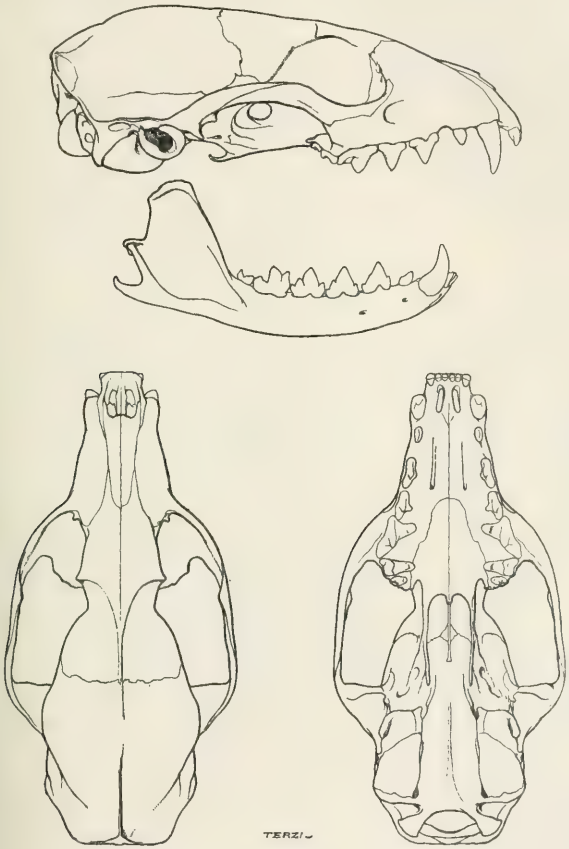

FIG. 94.
Genetta genetta. Reduced.

short but well developed median projection ; mesopterygoid space a little more than twice as long as wide, parallel-sided ; hamulars slender, with tapering, nearly horizontal extremities ; auditory bulla with anterior annular portion rather large, slightly

but evidently inflated, the large meatus without trace of tube; posterior inflated part of bulla moderate, much less high than wide, extending downward about to level of palate, and laterally barely reaching mastoid level, the greatest transverse diameter of inflated portion about two-thirds least breadth of basioccipital; paroccipital process short and wide, applied to and completely covering posterior surface of bulla, but not thin and scale-like as in *Mungos widdringtonii*; lambdoid crest high; sagittal crest evident posteriorly, but low and inconspicuous over middle and fore part of brain-case; mandible slender, the entire lower border convex to level of middle of coronoid process, the convexity scarcely more evident posteriorly than anteriorly; coronoid process with height above condyle about equal to width at same level.

Teeth.—The teeth do not differ markedly from those of *Mungos widdringtonii* except that they are less robust, a peculiarity especially noticeable in the lower premolars. Lower incisors very slender, with bilobation obscure. Anterior premolar both above and below simple, actually as well as relatively larger than in *Mungos widdringtonii*, its size greater than that of corresponding outer incisor, pm_1 with minute postero-basal cusp; second and third premolars triangular when viewed from the side, the two upper teeth without true secondary cusps, but both with cingulum rather prominent before and behind, and pm^3 often with a minute lobe near base of posterior cutting edge; inner median projection well developed and bearing a small cusp in pm^3, slightly indicated in pm^2; the two lower teeth with base scarcely longer, both with small but evident anterior and posterior cingulum cusp, and pm_3 with well developed median cusp on posterior cutting edge; fourth lower premolar like second and third but larger, the crown less narrow behind, and the cusp on posterior cutting edge better developed. Upper carnassial with well developed, cusp-bearing antero-internal lobe, the area of which is distinctly less than that of posterior heel; antero-external corner of crown with cusp-like cingulum; anterior border of crown rather abruptly concave; lower carnassial with the three anterior cusps large, the antero-external highest, the antero-internal less elevated, the postero-internal barely half the height of the others; posterior heel with area considerably less than half that of anterior portion of crown and not equal to that of posterior molar, a low but evident cusp near middle. First upper molar as in *Mungos*, but anterior border scarcely convex

FIG. 95.
Genetta genetta.
Teeth. Nat. size.

and posterior border nearly straight; cingulum often with indication of a minute cusp between protocone and paracone and another between protocone and metacone; paracone and metacone not well defined from each other but tending to coalesce to form a rather high commissure continued outward on parastyle. Second upper molar rather more than one-third first in area, its outer border extending to outer border of metacone of the larger tooth, owing to the presence of a distinct lobe representing parastyle. Second lower molar about as large as heel of carnassial, its cusps varying from two to four, often differing in the two jaws of the same animal.

Remarks.—Its slender form, elongate head, spotted body and ringed tail distinguish this animal at a glance from all other members of the European fauna. The material examined, while inadequate to any final conclusions, indicates the existence in south-western Europe of three local forms.

Genetta genetta genetta Linnæus.

1758. [*Viverra*] *genetta* Linnæus, Syst. Nat., I, 10th ed., p. 45 (Spain).

1816. *Viverra Genetta hispanica* Oken, Lehrb. der Naturgesch., II, pt. 3, p. 1010 (Ronda, Málaga, Spain).

1816. *Viverra Genetta gallica* Oken, Lehrb. der Naturgesch., II, pt. 3, p. 1010 (alternative name for *hispanica*, suggested on the supposition that the animal occurs in France also. Not *Viverra gallica* Kerr, Anim. Kingd., p. 167, 1792, based on some Genet from unknown locality).

1827. *Genetta vulgaris* Lesson, Man. de Mamm., p. 173 (Renaming of *genetta*).

1830. ? [*Genetta*] *communis* Burnett, Quart. Journ. Sci. Lit. Art, XXVIII, 1829, p. 349 (Substitute for *genetta*). Nomen nudum.

1897. *Genetta melas* Graels, Mem. Real Acad. Sci., Madrid, XVII, p. 175, pl. 2 A (Sierra Morena, Spain).

1898. [*Genetta*] *genetta* Trouessart, Catal. Mamm. viv. fors., p. 325.

1905. ? *Genetta peninsulæ* Cabrera, Bol. Real Soc. Espaü. Hist. Nat p. 266, May, 1905 (El Pardo, near Madrid, Spain).

1910. *Genetta genetta melas*, *G. genetta peninsulæ* and *G. afra* Trouessart, Faune Mamm. d'Europe, pp. 88, 89.

Type locality.—Spain.*

Geographical distribution.—Central and southern Spain; limits of range unknown.

Diagnosis.—Spots in first three rows at side of dorsal stripe tending to be distinct and occupying less space than light ground colour in same region, the largest about 20 mm. in diameter; ground colour of back a distinctly buffy grey.

Measurements.—Adult male and female from neighbourhood of Seville, Spain (approximate, from skin): head and body, 550

* Linnæus says: "Habitat in Oriente," an expression merely equivalent to "foreign." His first reference is to Ray, whose first locality is Spain. (see Thomas, Proc. Zool. Soc., London, 1911, p. 137).

and 560; tail, 445 and 470; hind foot, 81 and 84; ear, 46 and 43.

Specimens examined.—Nine, from the following localities in Spain: near Seville, 5 (B.M. and U.S.N.M.); near Madrid, 2; Valencia, 1 skull (U.S.N.M.); Gerona, 1 skull (U.S.N.M.).

Remarks.—On the basis of the few specimens that I have seen I am unable to recognize more than a single race of *Genetta* from the Iberian Peninsula, apart from the somewhat doubtful occurrence of the French form at the extreme north.

2 ♂, 2 ♀.	Seville, Spain. (*Dr. A. Ruiz.*)	Lord Lilford (P).	95. 3. 3. 5. 95. 9. 4. 2–4.
1.	Madrid.	Purchased (Parzudaki).	55. 11. 26. 3.

Genetta genetta balearica Thomas.

1902. *Genetta genetta balearica* Thomas, Ann. and Mag. Nat. Hist., 7th ser., x, p. 162, August, 1902. Type in British Museum.

1910. *Genetta genetta balearica* Trouessart, Faune Mamm. d'Europe, p. 88.

Type locality.—Inca, Majorca, Balearic Islands.

Geographical distribution.—Balearic Islands.

Diagnosis.—Similar to *Genetta genetta genetta* but general colour paler, a light cream-buff with faint brownish tinge; tips of hairs of underfur more whitish than in the continental Spanish animal; spots rather larger (many of them attaining a diameter of 30 mm.) but showing no peculiarities in arrangement.

Measurements.—Type (young-adult male): head and body, 520; tail, 480; hind foot, 87. Adult male and female from the same island: head and body, 580 and 550; tail, 440 and 420; hind foot, 85 and 82. For cranial measurements see Table opposite.

Specimens examined.—Four, all from the Island of Majorca.

♂, 1 ♀.	Majorca, Balearic Islands. (*Dr. Riutort.*)	O. Thomas (P).	1. 6. 1. 1–4. (1. 6. 1. 3. *Type* of subspecies.)

Genetta genetta rhodanica Matschie.

1902. *Genetta rhodanica* Matschie, Verhandl. des V Intern. Zool. Congr., Berlin, 1901, p. 1139.

1910. *Genetta genetta vulgaris* Trouessart, Faune Mamm. d'Europe, p. 86 (not *Genetta vulgaris* Lesson).

Type locality.—Montpellier, Herault, France.

Geographical distribution.—South-western France from the valleys of the Rhone and Loire to the Bay of Biscay; perhaps westward through the Asturias.

CRANIAL MEASUREMENTS OF *GENETTA GENETTA*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Mastoid breadth.	Rostral breadth over canines.	Depth of brain-case.	Palatal depth behind tooth-row.	Rostral depth behind *pm*1.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
G. genetta genetta.													
Spain; near Seville .	95, 9, 4, 2	♂	89·0	47·6	28·2	14·0	26·0	24·6	12·8	61·8	35·4	39·0	Teeth slightly worn.
,, ,, .	95, 9, 4, 3	♂	91·4	45·4	28·6	14·0	26·4	23·6	13·2	64·0	36·0	40·4	,, ,,
,, ,, .	95, 9, 4, 4	♀	87·0	46·4	27·4	13·8	26·6	24·0	12·0	61·0	34·2	37·2	,, ,,
Valencia . .	154144		86·6	45·0	27·8	13·8	26·2	25·4	12·0	60·0	34·0	37·4	,, ,,
G. genetta balearica.													
Spain: Mancor, Majorca, Balearic Islands	1, 6, 1, 1	♂	90·4	44·2	28·6	14·0	27·0	23·8	12·6	62·8	35·0	39·6	,, not worn.
Alcudia . .	1, 6, 1, 2	♂	91·8	48·0	30·0	14·6	28·0	25·6	13·0	65·0	36·4	39·0	,, slightly worn.
Inca . .	1, 6, 1, 3*	♂	91·8	45·0	30·0	14·8	27·6	24·2	12·0	64·2	36·2	41·0	,, not worn.
,, . .	1, 6, 1, 4	♀	87·0	45·0	29·0	14·0	26·0	23·6	12·0	59·0	34·6	37·0	,, ,,
G. genetta rhodanica.													
France: Biarritz, Basses-Pyrénées .	8, 1, 26, 1	♂	86·2	43·6	29·0	14·0	26·2	23·0	12·6	60·0	34·0	37·6	,, slightly worn.
,, ,,	8, 1, 26, 2	♂	90·2	45·0	27·6	14·0	26·0	23·0	12·0	62·0	35·2	38·4	,, ,,
Nîmes, Gard .	Mo. 13 Mottaz		87·8	45·0	28·0	13·0	27·0	23·0	11·0	60·0	33·8	36·0	,, ,,
Sainte-Cécile, Vaucluse .	8, 7, 11, 1	♀	88·6	44·6	28·2	14·0	26·8	24·6	12·2	60·8	34·8	38·0	,, ,,

* Type.

DENTAL MEASUREMENTS OF *GENETTA GENETTA*.

Locality.	Number.	Sex.	Upper carnassial.	First upper molar.	Lower carnassial.	Observations.
G. genetta genetta.						
Spain: near Seville	95. 9. 4. 2	♂	8·8 × 5·6	4·0 × 8·2	7·4 × 4·0	Teeth slightly worn.
,, ...	95. 9. 4. 3	♂	10·2 × 5·6	4·2 × 8·0	8·0 × 3·8	,, ,,
,, ...	95. 9. 4. 4	♀	9·0 × 5·0	3·6 × 7·8	7·4 × 3·6	,, ,,
Valencia	154144		9·8 × 5·2	4·0 × 8·0	7·6 × 4·0	,, ,,
G. genetta balearica.						
Spain: Mancor, Majorca, Belearic Island	1. 6. 1. 1	♂	10·0 × 5·8	3·0 × 8·0	7·4 × 3·6	,, not worn.
Alcudia ,, ,,	1. 6. 1. 2	♂	9·4 × 5·4	3·6 × 7·2	7·4 × 3·6	,, slightly worn.
Inca ,, ,,	1. 6. 1. 3	♂	9·6 × 5·2	3·6 × 7·6	7·6 × 3·6	,, not worn.
,, ,, ,,	1. 6. 1. 4	♀	9·2 × 5·0	3·4 × 7·2	7·2 × 3·4	,, ,,
G. genetta rhodanica.						
France: Biarritz, Basses-Pyrénées .	8. 1. 26. 1	♂	9·8 × 5·2	4·0 × 8·2	7·2 × 3·6	,, slightly worn.
,, ,, .	8. 1. 26. 2	♂	9·4 × 5·0	4·0 × 7·6	7·8 × 3·8	,, ,,
Sainte-Cécile, Vaucluse . .	8. 7. 11. 1	♀	10·2 × 5·2	4·0 × 8·2	7·8 × 4·0	,, ,,

Diagnosis.—Ground colour as in *Genetta genetta genetta*, but black spots smaller (rarely attaining a diameter of 20 mm.), more numerous, and showing a decided tendency to become confluent. In region occupied by first three rows of spots at each side of median stripe the black covers rather more space than the light ground colour.

Measurements.—Adult female from Sainte-Cécile, Vaucluse, France: head and body, 490; tail, 440; hind foot, 85; ear, 53. For cranial measurements see Table, p. 453.

Specimens examined.—Four, from the following localities in France: Sainte-Cécile, Vaucluse, 1; near Nîmes, Gard, 1 (Mottaz); near Biarritz, Basses-Pyrénées, 2.

Remarks.—An immature individual from Ferrol, Coruña, Spain, appears to be referable to this form rather than to true *genetta*.

♀.	Sainte-Cécile, Vaucluse, France.	M. Mourgue (C).	8. 7. 11. 1.
2 ♂.	Biarritz, Basses-Pyrénées.	Zoological Society (P).	8. 1. 26. 1–2.
1.	Ferrol, Coruña, Spain.	Dr. V. L. Seoane (C. & P.)	94. 11. 3. 2.

Family FELIDÆ.

1821. *Felidæ* Gray, London Med. Repos., xv, p. 302, April 1, 1821.

Geographical distribution.—Entire continental region of both Old and New Worlds, to the limits of tree growth; Malay Archipelago; in Europe west to Great Britain.

Characters.—Larger cheek-teeth of a strictly trenchant type, their crowns compressed and high, without the crushing surfaces, the last upper premolar and first lower molar persenting the extreme phase of carnassial modification, the inner lobe of upper carnassial small, in front of middle of crown; upper molar narrow, trenchant, the main axis of its crown transverse to tooth-row; auditory bulla highly inflated, divided by a septum into two chambers; form usually slender, the legs moderately long; size moderate to large; feet digitigrade; toes, 5–4.

Remarks.—The family *Felidæ* is one of the most widely distributed and sharply differentiated groups of carnivores. At present there is much difference of opinion as to the generic status of its members, all of which bear the unmistakable stamp of common descent. Two groups commonly regarded as genera occur in Europe.

KEY TO THE EUROPEAN GENERA OF *FELIDÆ*.

Small anterior upper premolar present, teeth 30; ear slightly or not tufted (Cats) ..... *Felis*, p. 456.

Small anterior upper premolar absent, teeth 28; ear conspicuously tufted (Lynxes) ..... *Lynx*, p. 470.

Genus **FELIS** Linnæus.

1758. *Felis* Linnæus, Syst. Nat., I, 10th ed., p. 41 (Type by tautonymy *Felis catus* Linnæus).

1855. *Catus* Fitzinger, Wiss.-pop. Naturgesch. der Säugeth., I, p. 265 (*catus* by tautonymy).

1857. *Felis* Blasius, Säugethiere Deutschlands, p. 159.

1858. *Catolynx* Severtzow, Rev. et Mag. de Zool., 2nd ser., X, p. 385 (*catus*).

Type species.—***Felis catus*** Linnæus.

Geographical distribution.—Tropical and northern temperate portions of the Old World; exact limits of range not known.

Characters.—Dental formula: $i\ \frac{3\ 3}{3\ 3}$, $c\ \frac{1\ 1}{1\ 1}$, $pm\ \frac{3\ 3}{2\ 2}$, $m\ \frac{1\text{-}1}{1\ 1} = 30$; anterior upper premolar small but well developed, rarely deciduous; skull broad, rounded and deep, the zygomatic breadth about three-quarters condylobasal length; external form slender, typically feline, the fur full and soft, not developing special manes or tufts.

Remarks.—In the uncertainty now existing with regard to the taxonomic rank of the various groups of cats the genus *Felis* is here regarded in its most restricted sense with respect to both characters and synonymy. As thus understood it contains about twenty species, mostly of the Old World. Three of these occur in Europe.

KEY TO THE EUROPEAN FORMS OF *FELIS*.

Fur of median dorsal area noticeably longer and coarser than that of sides; tail slender, its hairs about 30 mm. in length; no black stripes on shoulders or back.
- General colour of back and sides grey, the darker markings practically absent (Sardinia)..... *F. sarda*, p. 468.
- General colour of back and sides yellowish brown, the darker markings evident though faint (Crete) *F. agrius*, p. 470.

Fur of median dorsal area not noticeably longer and coarser than that of sides; tail thick, its hairs about 40 mm. long; two short black stripes between shoulders, and a long median black stripe on back..... *F. silvestris*, p. 457.
- Teeth enlarged (pm^3 and pm^4 together 19 to 20 mm.; three lower cheek-teeth together 22·4 to 23·6 mm.; m_1 9·2 to 10 mm.). Southern Spain..... *F. s. tartessia*, p. 465.
- Teeth normal (pm^3 and pm^4 together 16·6 to 19 mm.; three lower cheek-teeth together 18·8 to 22 mm.; m_1 8·0 to 8·8 mm.).
  - General colour light, approaching the smoke-grey of Ridgway; stripes on sides and legs obsolete (Central Europe)..... *F. s. silvestris*, p. 462.
  - General colour dark, approaching the broccoli-brown of Ridgway; stripes on sides and legs well defined (Scotland)..... *F. s. grampia*, p. 464.

FELIS SILVESTRIS Schreber.

(Synonymy under subspecies.)

Geographical distribution.—Central and southern Europe, from Great Britain eastward into Asia Minor; formerly occurring everywhere throughout its range, but now restricted to the wilder regions.

Diagnosis.—Size slightly larger than in the domestic cat, *Felis catus* Linnæus,* and form appearing more robust owing to the somewhat greater depth of the fur; tail rather more than half as long as head and body, its width at middle about 70 mm., abruptly, almost truncately, rounded at tip; fur soft and full, the hairs about 50 mm. long on sides, those along middle of back about 10 mm. longer, but not noticeably different in texture; occiput and nape with four longitudinal black stripes; two short longitudinal black stripes on middle of shoulder; a single median black stripe from back of shoulder to base of tail; sides with two or more brownish cross stripes; tail with black tip and two to four complete or nearly complete black rings; middle of chest obscurely or not spotted; ground colour of upper parts a very pale cream-buff overlaid with whitish and slightly darkened by the black annulations and tips of the longer hairs, the general effect about smoke-grey.

External characters.—General form essentially as in the domestic cat, but appearing heavier on account of the longer fur, a peculiarity especially noticeable in the tail. Fore foot with thumb much shorter than other digits, but bearing a well developed claw; third and fourth digits sub-equal and longest (the third slightly exceeding fourth), the second and third successively shorter; palm with obscurely trilobed, somewhat heart-shaped pad at base of longer digits; a rounded pad on ball of each digit, that on thumb small and inconspicuous, and a noticeable, subterete, almost horny excrescence near wrist; surface of all tubercles smooth; surface of palm elsewhere velvety-furred. Hind foot with digits and pads essentially as in fore foot except for absence of both hallux with its pad and posterior horny excrescence.

Colour.—Underfur of back and sides a cream-buff distinctly paler than that of Ridgway, the basal half of the hairs light drab-grey. Longer hairs whitish from base to just below tips of underfur, then blackish, followed by a whitish annulation about 7 mm. wide and a long black tip. The coincidence of the lower dark area with the terminal portion of the under hairs makes the latter appear at first sight brownish at tip. The general effect of the ground colour is a buffy grey frosted with whitish. This is very uniform throughout the head, back, sides and tail,

* For use of this name in place of *Felis domestica* Auct. see Pocock, Proc. Zool. Soc., London, 1907, p. 149, June 12, 1907.

but on outer side of front legs there is usually a sooty tinge, while the upper side of the feet becomes a nearly clear, light, buffy clay-colour. Underparts and inner surface of hind legs cream-buff, becoming whitish or white on chin, throat, fore part of chest and in intercrural region, and clouded and blotched with blackish across middle of chest and on inner side of fore legs, the amount of blotching on chest variable; soles and palms dark brown. Tail black at tip (about 70 mm.) and with two to four narrow (15 to 30 mm.) black or brownish rings, usually narrower or incomplete below, and often showing a tendency to become joined in median line above. The dark markings on upper parts and sides are typically as follows. Nape with four narrow longitudinal black stripes, these extending to head where they tend to become confused and confluent, and disappearing at front of shoulder. Just behind region where nape stripes disappear the shoulder has two usually well defined longitudinal stripes about 60 mm. in length and 10 mm. wide, lying 10 to 20 mm. apart. About 30 mm. behind the shoulder stripes the median dorsal stripe begins, often as a distinct spot, and continues to base of tail. The sides are marked with several transverse, frequently obsolete stripes, of which that starting at front of median dorsal stripe is usually the best developed, while those behind it tend to become mere wavy blotches, always preserving, however, when visible and when fur is smoothed, their general transverse and parallel arrangement.* In continuation of this system of transverse stripes, four or five fairly distinct, narrow (5 to 10 mm.) bands usually cross outer side of hind legs, and two or three narrower and less distinct bands may be detected on front legs. Ear like ground colour of back, the tip slightly blackish.

Skull.—The skull resembles that of *Felis catus* so closely that it is impossible to find tangible characters by which to distinguish it. In the larger races, however, a slightly greater size and massiveness may be attained than in the domestic cat. General aspect of skull broad, rounded and deep, the zygomata long and very widely spreading (zygomatic breadth equal to about three-quarters condylobasal length), the orbits nearly or quite surrounded by bone, very large (diameter greater than that of interorbital region, and area equal to or greater than that of rostrum when skull is viewed from in front). Dorsal profile of skull convex throughout, sometimes a little flattened in interorbital region and along nasals, the latter occasionally terminating in a slight anterior concavity; nasals sloping very abruptly forward and downward, the palatal depth at their posterior extremity at least twice as great as that at front: from posterior

* There is never any trace of the spiral arrangement of the dark markings characteristic of the typical form of the domestic *Felis catus* as described and figured by Pocock, Proc. Zool. Soc., London, 1907, pp. 143–168, pls. VIII and IX.

extremity of nasals the convexity of the dorsal profile is more gradual and regular to slightly overhanging lambdal region: occiput obliquely truncate but not noticeably concave, the condyles not visible when skull is viewed from above; ventral profile flat throughout. Brain-case broadly ovate or nearly globular when viewed from above, the posterior outline distorted in older specimens by the projecting lambdoid border, the greatest width above zygomata slightly greater than depth at

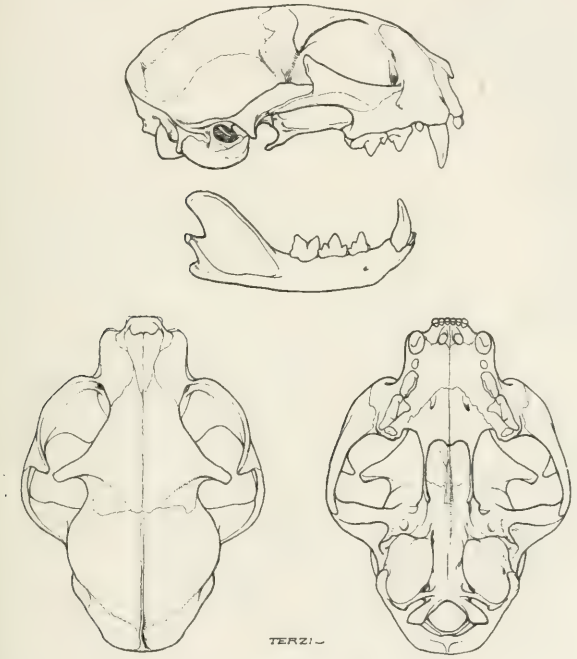

FIG. 96.
Felis silvestris. × ½.

middle, and about equal to distance from posterior border of parietal to deepest portion of postorbital constriction; sagittal crest low, appearing first on interparietal, the only region where it becomes a true crest, the muscular ridges in front of interparietal at first separate and forming a lyre-like figure, but later uniting in continuation of the median crest. Floor of brain-case flat, without noticeable surface features; auditory bullæ large, highly inflated, longer than broad, formed mostly by

posterior chamber, the surface smooth, the meatus large, not tubular; width of basioccipital at middle less than that of bulla in same region; mastoid and paroccipital processes small, the latter thin and plate-like, both closely applied to surface of bulla. Postorbital region abruptly contracted behind postorbital process, the depth of the constriction increasing with age; postorbital process very large, at first triangular in outline, afterward becoming ligulate, its upper surface obliquely flattened. Interorbital region much constricted, its least width considerably less than that of orbit. Rostrum short and deep, the distance from orbit to gnathion about equal to breadth over canines and slightly less than palatal depth at posterior extremity of nasals; nasal branch of premaxillary broad, its width at front of nasal often nearly equal to that of nasal in same region; anteorbital foramen moderately large, opening directly forward under overhanging rim of orbit and above middle of first large premolar. Palate broad, triangular in outline, its width including molars about equal to median length, the median posterior extension slight, but usually marked off at each side by a lateral emargination extending in some instances nearly to level of middle of carnassial; incisive foramina moderately large, elliptical in outline, slightly oblique, extending from level of middle of canine to middle of space between canine and outer incisor; mesopterygoid space nearly parallel-sided, somewhat longer than wide, its anterior border double-concave (encroached on by blunt median spine of palate); hamulars slender, a little converging; external pterygoid process well developed, laminate, angular, much smaller than hamular. Mandible rather slender, the anterior border of coronoid rising at an angle of only about 50°, the distance from apex of process to posterior border of molar about equal to that from latter point to front of symphysis; lower profile of ramus slightly convex, though with anterior and posterior flattened regions; angular process straight, rather short, a little below level of alveolar line.

Teeth.—As a whole, and in comparison with that of European Carnivores of other families, the dentition appears rather weak, owing to the complete suppression of all crushing surfaces and the consequent narrowness of the cheek-teeth. Incisors small and weak, the crown area of i^3, the largest tooth, about equal to that of i^1 and i^2 together and scarcely more than one-eighth that of canine; upper incisors forming a continuous, straight or faintly convex row separated from canine at each side by a well marked diastema nearly as wide as base of canine; i^1 and i^2 subequal, the second tooth slightly the larger, the crowns a little compressed, slightly higher than wide when viewed from in front, spatulate in outline, the cutting edge without cusps or lobes, but a little higher at middle than at sides, posterior border somewhat concave with faintly developed heel; i^3 with cutting edge oblique, and crown more nearly terete. Lower incisors

smaller than corresponding upper teeth, their crowns rounded and flattened, with faintly indicated longitudinal groove. Canines simple, without cingulum, rather large, the shaft curved very slightly backward, that of upper tooth terete with a few longitudinal grooves in enamel, that of lower slightly hollowed on inner and posterior surface. Anterior upper premolar about as large as outer incisor, though with crown not so high, its root single, but often showing indications of longitudinal division. Its usual position is a little behind middle of wide diastema between canine and first large premolar. Other premolars (except carnassial) essentially alike in form, two-rooted, the crowns compressed, triangular when viewed from the side, somewhat longer than high, the base elliptical, slightly wider posteriorly than anteriorly, that of pm^3 wider than the others and somewhat inclined to assume a concavo-convex outline; anterior border of pm^3 simple, that of pm_3 and pm_4 with a small basal cusp (better developed in latter than in former); posterior borders of all three teeth with two secondary cusps, the basal formed by the rudimentary cingulum, the second on base of main cusp; pm_3 slightly smaller than the others. Upper carnassial about twice as long as broad, the outline of its crown almost an isosceles triangle, though inner side is slightly longer than outer; inner lobe at anterior border of crown, scarcely breaking the general contour, its cusp low but well developed, terete; outer or main cutting portion of tooth with three cusps, the anterior low and very similar to that of inner lobe, the median and posterior of the usual carnassial type, the posterior cutting edge nearly horizontal and meeting anterior commissure at an abrupt angle (about 50°). Upper molar small, transversely compressed imperfectly two-rooted, the crown about half as long as wide without definite structure though showing traces of an outer and inner cusp. Lower molar consisting of a sub-equal paraconid and protoconid, the latter slightly the larger, the anterior and posterior borders of tooth nearly vertical, the upper border formed by the two sub-equal commissures, both of which slope downward toward the middle, where they meet at an angle of about 50°; outer surface of tooth convex longitudinally, inner surface rather deeply concave.

FIG. 97.
Felis silvestris. Teeth. Nat. size.

Remarks.—Externally *Felis silvestris* is distinguishable from domestic cats with well developed markings of the "striped tabby" type* by slightly greater size and by the somewhat

* For figures of the two main types of marking in domestic cats see Pocock, Proc. Zool. Soc., London, 1907, pls. VIII and IX.

longer fur, this giving the animal the appearance of more robust legs and less tapering tail. The skull and teeth differ only in the greater average size of fully adult individuals, a character

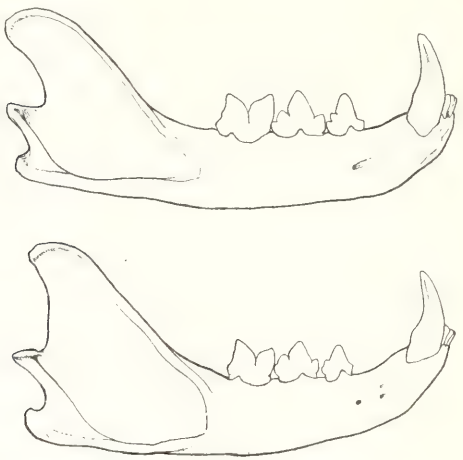

FIG. 98.
Felis silvestris (upper figure) and *F. catus* (lower figure). Nat. size.

most readily appreciable in the teeth. In twenty European specimens of *Felis silvestris* and a like number of *F. catus* the extremes for certain dental measurements are as follows :—

	silvestris.		*catus.*
Combined length of upper carnassial and pm^3	16·6 to 20·0	..	15·0 to 17·8
Combined length of lower cheek-teeth	18·8 ,, 23·6	..	18·0 ,, 20·4
Lower molar	7·8 ,, 10·0	..	6·6 ,, 8·6

FELIS SILVESTRIS SILVESTRIS Schreber.

1758. [*Felis*] *catus* Linnæus, Syst. Nat., I, 10th ed., p. 42 (part; synonyms only, the description refers to the domestic cat).
1777. *Felis* (*Catus*) *silvestris* Schreber, Säugthiere, III, p. 397.
1777. [*Felis catus*] *ferus* Erxleben, Syst. Regni Anim., I, p. 518.
1857. *Felis catus* Blasius, Säugethiere Deutschlands, p. 162 (Not of Linnæus).
1896. *Catus ferox* Martorelli, Atti Soc. Ital. Sci. Nat., Milano, XXXV, p. 253, January, 1896 (Accidental renaming of *Catus ferus* Brehm, Illustr. Thierleben, I, p. 275, 1863).
1907. *Felis sylvestris* Pocock, Proc. Zool. Soc., London, p. 150, June 12, 1907.
1910. *Felis silvestris* Trouessart, Faune Mamm. d'Europe, p. 98.

Type locality.—Germany.
Geographical distribution.—Central and southern continental

Europe from northern Spain to northern Germany, and from the Atlantic coast eastward at least to the Black Sea ; eastern limits of range not known.

Characters.—Teeth not unusually large (combined length of upper carnassial and pm^3 16·6 to 19 mm. ; three lower cheek-teeth together, 18·8 to 22 mm. ; lower molar, 8·0 to 8·8 mm.) ; general colour light, the predominant hue approaching the smoke-grey of Ridgway ; dark markings on sides and legs tending to be faint, brownish and ill-defined.

Measurements.—Adult male from northern Germany : head and body, 545 ; tail, 310 ; hind foot, 135 ; ear from meatus, 63. A specimen (not sexed) from Ingelheim, Rheinhessen, Germany : head and body, 481 ; tail, 309 ; hind foot, 119. Adult from near Athens, Greece : hind foot, 127. For cranial measurements see Table, p. 466.

Specimens examined.—Fifteen, from the following localities :—
Spain : Province of Burgos, 3 (B.M. and U.S.N.M.).
France : Manonville, Meurthe-et-Moselle, 1 ; Salavon, Haute-Marne, 1 ; Caterille, Haute-Garonne, 1.
Germany : North Germany (no exact locality), 1 ; Ingelheim, Rheinhessen, 1 ; south Germany (no exact locality), 3 (skulls).
Austria-Hungary : Baranza, Hungary, 1 (skull).
Bulgaria : Varna, 1 (Andersen, skull).
Greece : Near Athens, 1.
Italy : Near Rome, 2.

Remarks.—The wild cat of central Europe shows little individual variation in colour, or in pattern and character of markings. The two skins from Rome and that from Athens appear to be identical with more northern specimens. In the skull from Varna, Bulgaria, the nasals are not narrowed as in the form occurring in Asia Minor and the Caucasus.

2.	Prov. Burgos, Spain.	S. and N. Gonzalez (c).	8. 7. 7. 10–11.
♂.	Manonville, Meurthe-et-Moselle, France. (*Lomont.*)	Dr. E. Hamilton (p).	95. 11. 9. 1.
♂.	Salavon, Haute-Marne. (*Lomont.*)	Dr. E. Hamilton (p).	95. 11. 9. 2.
♂.	Caterille, Haute-Garonne. (*A. Robert.*)	O. Thomas (p).	8. 7. 15. 1.
♂.	N. Germany.	Lord Lilford (p).	95. 5. 1. 1.
3 skulls.	S. Germany.	Dr. A. Günther (c).	59. 9. 6. 55–57.
1.	Ingelheim, Rheinhessen, Germany. (*Erlanger.*)	G. Barrett-Hamilton (p).	11. 1. 2. 104.
♂.	Baranza, Hungary.	Dr. E. Hamilton (p).	2. 6. 3. 1.
1.	Athens, Greece.	C. W. L. Merlin (p).	47. 7. 22. 2.

Felis silvestris grampia Miller.

1907. *Felis grampia* Miller, Ann. and Mag. Nat. Hist., 7th ser., xx, p. 396, November, 1907. Type in British Museum.
1910. *Felis grampia* Trouessart, Faune Mamm. d'Europe, p. 99.

Type locality.—Invermoriston district, Inverness, Scotland.

Geographical distribution.—Formerly throughout Great Britain; now restricted to the wilder portions of Scotland.

Diagnosis.—Like *Felis silvestris silvestris* but general colour darker, the predominant hue approaching the broccoli-brown of Ridgway; dark markings on sides and legs tending to be extensive, blackish and well defined.

Colour.—Underfur of back and sides a light ochraceous-buff, the basal half of the hairs mouse-grey. Light annulations of longer hairs very nearly the cream-buff of Ridgway. Black tips to longer hairs more noticeable than in *Felis silvestris*, and general effect of ground colour distinctly browner, the light colour not producing any frosted appearance. Upper side of feet and inner surface of hind legs ochraceous-buff, becoming duller and somewhat drab-tinged on under side of body. Intercrural and pectoral white areas well defined and strongly contrasted with surrounding colour. Black mottling on middle of chest conspicuous. Soles and palms blackish. Dark markings on tail, legs and upper parts similar to those of *Felis silvestris* in arrangement, but more definite in outline, particularly the transverse stripes on outer side of forelegs and those on posterior half of body.

Skull and teeth.—The skull and teeth are not distinguishable from those of typical *Felis silvestris*.

Measurements.—Type (young-adult male): head and body, 534; tail, 338; hind foot, 127; ear, 67. Young-adult male and female from the type locality: head and body, 534 and 534; tail, 280 and 290; hind foot, 126 and 123; ear from meatus, 67 and 68.

Specimens examined.—Twenty-two, from the following localities in Scotland: Glencassley, Sutherland, 2; Lochcarron, Ross, 2; Aberdeenshire, 1; Invermoriston district, Inverness, 5; Beauly, Inverness, 1; Fort William, Inverness, 2; Knoydart, Inverness-shire, 2; Arisaig, Inverness-shire, 1; Braulea Forest, Inverness-shire, 1; Balmachan, Inverness-shire, 1; Jardine House, Dumfriesshire, 1; Inverness (no exact locality), 1; Scotland (no exact locality), 2.

Remarks.—The British wild cat differs from true *Felis silvestris* in darker general colour and more pronounced black markings, characters in which it approaches *F. s. tartessia*. It does not show, however, any tendency to the enlargement of teeth so noticeable in the south-Spanish form.

skull.	Glencassley, Sutherlandshire, Scotland.	E. R. Alston (P).	79. 9. 25. 81.
♂.	Glencassley, Sutherlandshire.	Mrs. Flower (P).	92. 10. 21. 1.

3 ♂, ♀.	Invermoriston, Inverness-shire.	A. H. Cocks (P).	4. 1. 25. 2–5. (4. 1. 25. 3. *Type* of subspecies.)
♂ st.	Invermoriston, Inverness-shire.	Hon. N. C. Rothschild (P).	1. 5. 22. 4.
1.	Beauly, Inverness-shire.	Lord Tweedmouth (P).	5. 10. 12. 1.
2 ♂.	Knoydart, Inverness-shire.	Sir Herbert Maxwell (P).	98. 12. 26. 1. 99. 2. 9. 1.
1.	Arisaig, Inverness-shire.	Dr. E. Hamilton (P).	2. 6. 3. 4.
♀.	Braulin Forest, Inverness-shire.	G. W. Henderson (P).	6. 12. 18. 1.
st.	Balmachan, Inverness-shire.	J. E. Harting (P).	83. 11. 13. 1.
st.	Jardine House, Dumfries.	Sir W. Jardine (P).	86. 7. 2. 13.
1.	Scotland.		114B.

Felis silvestris tartessia Miller.

1907. *Felis tartessia* Miller, Ann. and Mag. Nat. Hist., 7th ser., xx, p. 397, November, 1907. Type in British Museum.
1910. *Felis tartessia* Trouessart, Faune Mamm. d'Europe, p. 99.

Type locality.—Coto Doñana, Huelva, Spain.

Geographical distribution.—Southern Spain; limits of distribution not known.

Diagnosis.—Like *Felis silvestris silvestris* but larger and with disproportionately larger teeth. Colour darker, and black markings essentially as in *F. silvestris grampia*.

Colour.—The colour is noticeably darker than in *Felis silvestris silvestris*, rather nearly approaching that of *F. s. grampia* but less brownish. Underfur more slaty at base than in the related forms, about the grey No. 6 of Ridgway, its terminal portion a dull cream-buff. Pale annulations on longer hairs nearly as whitish as in *F. silvestris silvestris*. Inner surface of hind legs a light ochraceous-buff; rest of underparts as in *F. s. grampia*. Dark markings well defined, their arrangement and extent as in the British wild cat.

Skull.—In fully adult males the skull is very large, apparently exceeding that of any of the other members of the group. Its form, however, is not peculiar.

Teeth.—The teeth of the Spanish wild cat are noticeably larger than those of any of the other members of the *Felis silvestris* group, or of the domestic cats. The difference is particularly evident in the premolars both above and below and in the lower molar (see measurements, p. 467). In form, however, the teeth show no peculiarities.

Measurements.—Type (adult female) from well-made skin: head and body, 650; tail, 350; hind foot, 133. For cranial and dental measurements see Tables, pp. 466 and 469.

Specimens examined.—Eight, from the following localities in southern Spain: Sierra Morena, 1; Coto Doñana, Huelva, 5; Andalucia (no exact locality), 2 (skulls).

CRANIAL MEASUREMENTS OF *FELIS SILVESTRIS* AND *F. SARDA*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Mastoid breadth.	Postorbital constriction.	Interorbital constriction.	Rostral breadth over canines.	Depth of brain-case at middle.	Palatal depth.	Depth of rostrum behind canine.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
F. silvestris silvestris.															
France: Manonville, Meurthe-et-Moselle	95. 11. 9. 1	♂	—	65·0	—	32·4	18·4	23·2	—	33·0	19·6	56·0	30·2	32·0	Teeth slightly worn.
Salavon, Haute-Marne	95. 11. 9. 2	♂ juv.	—	59·0	—	36·0	16·0	22·0	—	29·0	16·0	55·4	29·0	32·0	,, not worn.
Caterille, Haute-Garonne	8. 7. 15. 1	♂ juv.	81·0	59·6	40·2	33·2	16·8	22·8	35·4	33·0	15·0	55·6	28·6	31·0	,, ,,
Germany: southern Germany	1143*d*	♂	86·0	67·0	42·0	33·8	18·0	24·4	36·0	31·4	17·0	62·0	28·0	31·0	,, ,,
,, ,,	1143*f*	♂ ?	88·0	69·0	44·4	35·0	19·6	25·0	36·0	34·0	19·0	—	30·0	—	,, slightly worn.
Austria-Hungary: Baranza	2. 6. 3. 1	♂	96·0	74±	45·2	27·4	18·0	27·4	36·4	35·0	20·0	71·0	32·0	35·0	,, ,,
Bulgaria: Varna	Andersen	♂	95·0	72·2	45·2	34·8	20·8	26·8	37·0	36·2	20·2	68·0	31·6	34·6	,, ,,
Greece: near Athens	47. 7. 22. 2		—	68·0	—	35·0	18·0	24·0	—	—	18·0	64·0	31·0	33·6	,, ,,

F. silvestris grampia.															
Scotland: Inverness. .	Zool. Soc.	♂	89·0	67·8	42·8	32·6	19·8	26·0	36·8	31·6	19·6	63·2	30·2	33·6	Teeth not worn.
,, . .	4. 1. 25. 2	♂	85·0	61·0	41·4	34·0	17·0	26·0	36·0	31·4	17·0	60·0	30·4	32·0	,, ,,
,, . .	4. 1. 25. 3*	♂	87·0	66·0	43·8	34·6	18·6	25·0	37·0	31·4	16·0	63·0	29·6	32·4	,, slightly worn.
,, . .	4. 1. 25. 4	♂	87·0	64·4	42·4	34·6	18·4	24·6	36·0	31·6	18·2	61·0	30·0	32·6	,, ,,
Sutherland .	79. 9. 25. 81	♂?	90·0	67·0	43·0	35·4	19·0	25·0	36·0	31·0	18·8	62·4	30·4	33·8	,, ,,
Inverness. .	4. 1. 25. 5	♀	82·2	63·4	44·0	34·6	18·0	23·8	37·0	29·8	16·4	60·0	27·6	29·4	,, not worn.
F. silvestris tartessia.															
Spain: Sierra Morena .	—		—	72·4	42±	33·0	19·6	27·8	—	33·6	20·0	65·6	32·8	34·6	
Coto Doñana, Huelva . .	7. 6. 4. 1*	♂	93±	76·4	47·2	33·0	21·6	29·0	—	33·0	20·4	69·0	33·0	35·4	,, slightly worn.
,, ,,	2. 6. 3. 2	♂	93±	71·4	45·0	29·0	19·0	27·8	37·0	33·4	20·2	—	33·4	—	,, not worn.
,, ,,	2. 6. 3. 3	♀	84±	62·8	42·4	31·2	16·4	25·0	33·0	30·0	17·6	59·0	31·0	34·4	,, ,,
,, ,,	8. 3. 8. 1		10·32	79·6	—	31·8	22·6	33·2	—	36·0	22·4	74·4	35·0	38·0	,, slightly worn.
F. sarda.															
Sardinia: Sarrabus . .	88. 12. 1. 1	♂	89·0	71·4	41·2	34·0	19·2	25·0	37·0	33·0	20·0	64·0	31·0	33·2	,, ..
,, . .	Lataste*	♂	"87·0"	"66·0"											

* Type.

Remarks.—The Andalusian form of *Felis silvestris* is well characterized by its large teeth and rather dark colour.

1.	Coto Doñana, Huelva, Spain.	A. Chapman (c & p). (*Type* of subspecies.)	7. 6. 4. 1.
1.	Coto Doñana, Huelva.	A. Chapman (p).	8. 3. 8. 1.
♂, ♀.	Andalucia. (*Chapman.*)	Dr. E. Hamilton (p).	2. 6. 3. 2–3.

FELIS SARDA Lataste.

1885. [*Felis libyca*] var. *sarda* Lataste, Actes Soc. Linn., Bordeaux, xxxix, p. 231 (p. 109 of reprint), September, 1885. Type in Lataste collection.

1896. *Felis mediterranea* Martorelli, Atti Soc. Ital. Sci. Nat., Milano xxxv, p. 266, January, 1896 (Sardinia).

1910. *Felis ocreata sarda* Trouessart, Faune Mamm. d'Europe, p. 101.

Type locality.—Sarrabus, Sardinia.

Geographical distribution.—Sardinia, and according to Martorelli portions of the mainland of western Italy.

Diagnosis.—Differs from *Felis silvestris* and resembles the African *F. ocreata* in the shorter fur and more slender tail (average length of hairs at middle about 30 mm. instead of 40 mm.); hairs of median dorsal line slightly elongated and stiffened, forming a faint ridge or rudimentary mane; dark markings obsolete, the back and sides greyish or brownish, without definite stripes.

Colour.—Underfur drab-grey through basal half, the terminal half of hairs ochraceous-buff. Pale annulations nearly white. The pale annulations and black tips form a clear grey grizzle in which the ochraceous-buff scarcely appears except when fur is disarranged. Pale annulations on elongated dorsal hairs dull buff, giving this region a brownish cast noticeably different from sides, but not producing any suggestion of the clearly defined stripe characteristic of the members of the *silvestris* group. No stripes on nape, shoulders or sides, but the position of the typical markings faintly indicated by shadings in the grizzle. Dark markings on legs as in the *silvestris* group. Back of ear yellowish clay-colour, the extreme tip black. Feet pale, dull buff above, black below. Inner surface of hind legs bright ochraceous-buff, fading toward buff on chest and anterior portion of belly. Dark mottling on chest moderately distinct. Tail with well defined black tip, but with other markings obscure, the general effect essentially like mid-dorsal area.

Skull.—The skull closely resembles that of *Felis silvestris*, except that in the few specimens examined the auditory bullæ are higher and more inflated anteriorly, a difference which may prove to be purely individual.

Teeth.—The teeth are larger than in true *Felis silvestris*, nearly equalling those of the Spanish form.

Measurements.—Type (adult male), from skin: head and

DENTAL MEASUREMENTS OF *FELIS SILVESTRIS* AND *F. SARDA*.

Locality.	Number.	Sex.	Pm^3 and pm^4 together.	Three lower cheek-teeth.	Lower molar.
F. silvestris silvestris.					
France: Manonville, Muerthe-et-Moselle	95. 11. 5. 1	♂	18·2	—	—
Salavon, Haute-Marne	95. 11. 5. 2	♂	18·2	21·2	8·8
Caterille, Haute-Garonne	8. 7. 15. 1	♂	17·6	20·2	8·0
Germany: southern Germany	1143*d*	♂	16·6	18·8	8·0
,, ,,	1143*f*	♂?	17·2	—	—
Austria-Hungary: Baranza	8. 7. 7. 10	♂	18·8	21·8	8·4
Bulgaria: Varna	Andersen	♂	17·8	21·0	8·2
Greece: near Athens	47. 7. 22. 2	—	19·4	22·4	8·8
F. silvestris grampia.					
Scotland: no exact locality	5. 10. 12. 1	—	17·6	20·8	8·0
,, ,,	114*b*	—	18·0	20·4	8·0
Sutherland	79. 9. 25. 81	♂?	18·4	21·6	8·4
Fort William	99. 2. 9. 1	♂	17·4	21·0	8·0
Inverness-shire	Zool. Soc.	♂	18·0	21·0	8·2
,,	4. 1. 25. 2	♂	18·6	21·2	8·0
,,	4. 1. 25. 3*	♂	16·8	21·0	8·0
,,	4. 1. 25. 4	♂	18·0	21·0	8·0
,,	98. 12. 26. 1	♂	17·6	21·0	8·0
,,	4. 1. 25. 5	♀	16·6	19·8	7·8
,,	6. 12. 18. 1	♀	16·8	19·0	7·8
F. silvestris tartessia.					
Spain: Sierra Morena	—	—	19·0	22·4	9·2
Coto Doñana, Huelva	7. 6. 4. 1*	♂	19·8	23·6	9·4
,, ,,	2. 6. 3. 2	♂	19·8	—	—
,, ,,	2. 6. 3. 3	♀	19·8	23·4	10·0
,, ,,	8. 3. 8. 1	—	20·0	22·8	9·2
F. sarda.					
Sardinia: Sarrabus	88. 12. 1. 1	♂	19·4	22·2	9·0

* Type.

body, 600; tail, 300; hind foot, 124. For cranial and dental measurements see Tables, pp. 466 and 469.

Specimens examined.—Sixteen, all from Sardinia (B.M., Turin, Genoa, and Lataste).

♂.	Ogliastra, Sardinia. (*Dr. Wolterstorff.*)	O. Thomas (P).	0. 5. 24. 1.
♂.	Sarrabus.	Marquis G. Doria (P).	88. 12. 1. 1.
1.	Sardinia.	Purchased (Linnæa, Berlin.)	86. 7. 10. 1.

FELIS AGRIUS Bate.

1906. *Felis ocreata agrius* Bate, Proc. Zool. Soc., London, 1905, II, p. 317, April 3, 1906.

1910. *Felis ocreata agrius* Trouessart, Faune Mamm. d'Europe, p. 102.

Type locality.—Crete.

Geographical distribution.—Crete.

Diagnosis.—Similar to *Felis sarda*, but paler and more yellow in general colour, and dark markings of shoulders and back less obsolete.

Colour.—The elements of the colour are essentially as in *Felis sarda*, but the ochraceous-buff of underfur is not so dark, and the black tips and annulations of the longer hairs are not so extensive. As a result, the general colour is a yellowish grey, made up chiefly of a mixture of the ochraceous-buff and the whitish sub-terminal annulations, very slightly darkened by the black. While there are no black markings on body or legs, the longitudinal shoulder stripes and dorsal stripe, as well as the transverse lateral stripes, are clearly indicated, when fur is smooth, by brownish shades. Tail with black tip and two or three black sub-terminal rings. Outer surface of ear dull buffy clay-colour, becoming blackish at tip. Feet buffy above, darker and somewhat clouded with blackish below. Inner surface of hind legs and middle of chest light ochraceous-buff; belly slightly darker than in *Felis sarda*, the mottling obsolete.

Skull and teeth not known.

Specimens examined.—Two skins, both from Crete.

2.	Kanea, Crete.	Miss D. Bate (c).	5. 12. 2. 14–15. (5. 12. 2. 15. *Type* of species.)

Genus LYNX Kerr.

1792. *Lynx* Kerr, Anim. Kingd., Systematic catalogue inserted between pages 32 and 33. (Type by tautonymy *Lynx vulgaris* Kerr = *Felis lynx* Linnæus.)

1821. *Lynceus* Gray, London Med. Repos., XV, p. 302, April 1, 1821 (*Felis lynx* Linnæus).

1829. *Pardina* Kaup, Entw.-Gesch. u. Natürl. Syst. Europ. Thierwelt, I, p. 53 (*Felis pardina* Temminck = *Lynx pardellus* Miller).

1834. *Lynchus* Jardine, Naturalists' Library, Mamm., II, p. 274 (*Felis lynx* Linnæus).

1857. *Lynx* Blasius, Säugethiere Deutschlands, p. 161 (Sub-genus of *Felis*).

1867. *Cervaria* Gray, Proc. Zool. Soc., London, p. 276 (*Lyncus pardinus* = *Lynx pardellus* Miller; type fixed by Miller and Rehn, Proc. Boston Soc. Nat. Hist., XXX, p. 199, December 27, 1901). Not of Walker, 1866.

1903. *Eucervaria* Palmer, Science, N.S., XVII, p. 873, May 29, 1903 (Substitute for *Cervaria* Gray).

Type species.—*Felis lynx* Linnæus.

Geographical distribution.—Northern forested portions of both Old and New Worlds; in Europe south to the Mediterranean coast and west to the Atlantic (perhaps within historic times to Great Britain).

Characters.—Similar to *Felis* but without small upper premolar, form heavier and less typically feline, ears tufted.

Remarks.—As in the case of the genus *Felis* the limits of the genus *Lynx* are not clearly understood. As here restricted the group includes about a dozen named, but for the most part imperfectly known forms peculiar to the Northern Hemisphere. Two of them occur in Europe.

KEY TO THE EUROPEAN SPECIES OF *LYNX*.

Length of lower cheek-teeth together about 35 mm.; skull relatively long and low, the interorbital convexity moderate; back and sides never thickly spotted, usually without dark markings; cheeks not conspicuously whiskered (Northern and central Europe) ..... *L. lynx*, p. 471.

Length of lower cheek-teeth together about 30 mm.; skull relatively short and deep, the interorbital convexity abrupt; back and sides thickly spotted (Iberian Peninsula) ..... *L. pardellus*, p. 475.

LYNX LYNX Linnæus.

1758. [*Felis*] *lynx* Linnæus, Syst. Nat., I, 10th ed., p. 43 (Sweden).

1792. *Lynx vulgaris* Kerr, Anim. Kingd., Systematic catalogue inserted between pp. 32 and 33; described, p. 157.

1792. *Lynx vulgaris alba* Kerr, Anim. Kingd., Systematic catalogue inserted between pp. 32 and 33; described, p. 157 (Forests of Sweden).

1792. ? *Lynx vulgaris melina* Kerr, Anim. Kingd., Systematic catalogue inserted between pp. 32 and 33; described, p. 157 (Banks of the Volga near Cazan, Russia).

1798. *F[elis] borealis* Thunberg, Beskrifning pa Svenske Djur, Mamm., p. 14 (Heavy forests of northern Sweden).

1798. *Felis kattlo* Schrank, Fauna Boica, I, p. 52 (Bohemia).

1820. *Felis lyncula* Nilsson, Skand. Fauna, I, p. 14 (Wooded and mountainous regions of Scandinavia).

1825. *Felis lupulinus* Thunberg, Denkschr. k. Akad. Wissensch., München, IX, p. 189 (Northern Scandinavia).

1825. *Felis vulpinus* Thunberg, Denkschr. k. Akad. Wissensch., München, IX, p. 192 (Near Upsala, Sweden).

1829. *Felis virgata* Nilsson, Illum. Fig. Skand. Fauna, pls. 3 and 4 (Wooded and mountainous portions of Sweden).
1857. *Felis lynx* Blasius, Säugethiere Deutschlands, p. 173.
1870. *Lynx cervaria* Fitzinger, Sitzungsber. kais. Akad. Wissensch., Wien, Math.-Naturwiss. Classe, LX, Abth. I, p. 208 (Not *Felis cervaria* Temminck, 1827).
1904. [*Lynx*] *lynx* Trouessart, Catal, Mamm., Suppl., p. 276.
1910. *Lynx lynx* Trouessart, Faune Mamm. d'Europe, p. 103.

Type locality.—Near Upsala, Sweden.

Geographical distribution.—Wooded portions of Europe from the extreme north to the Alps and Pyrenees, and from the Atlantic coast eastward. Now practically exterminated except in the wilder portions of the Scandinavian Peninsula.

Diagnosis.—Length of lower cheek-teeth together about 35 mm.; skull relatively long and low, the interorbital convexity moderate; back and sides never thickly spotted, usually without dark markings; cheeks not conspicuously whiskered; underfur dense and woolly.

External characters.—Form heavier and more dog-like than in *Felis silvestris*, the legs relatively longer and feet more robust, the tail decidedly less than half as long as head and body. Ear conspicuously tufted at tip, and hairs on side of head below ear and behind angle of jaw somewhat elongated. Digits and tubercles as in *Felis silvestris*, the claw on thumb especially well developed, the horny excrescence on palm near wrist wider at base; hairy covering of both palm and sole woolly rather than velvety in texture. Tail shorter than hind foot. Underfur everywhere densely woolly.

Colour.—Upper parts and sides varying from yellowish brown to brownish grey, the back usually frosted by white hair-tips except along median region, and sometimes rather thickly sprinkled, especially in immature individuals, with small black spots or short streaks tending to arrange themselves in about five longitudinal rows, but spotting never so conspicuous as in *Lynx pardellus*. Head like back, the face with a few indistinct longitudinal dark streaks; a whitish eye ring about 5 mm. wide interrupted in front and behind; median portion of upper eyelid black; a small black spot on side of head below ear; inner surface of ear whitish; outer surface like crown on basal half, but posterior border and tip, including pencil, black, the intermediate region whitish; contrast of whitish area sometimes heightened by a dark shade along its lower border. Underparts ranging from whitish to pale bluff. Feet intermediate between back and belly; front of forearm and of thigh usually with a few black or dark brown specks; tail and posterior surface of thigh somewhat darker than upper parts, often with a slight rusty tinge, the tip of tail black. Underfur usually brownish or buffy to extreme base, but occasionally grey.

Skull.—The skull of *Lynx lynx* differs in general aspect from

that of *Felis silvestris* in much greater size and massiveness (condylobasal length of skull in adult males exceeding 140 mm.)

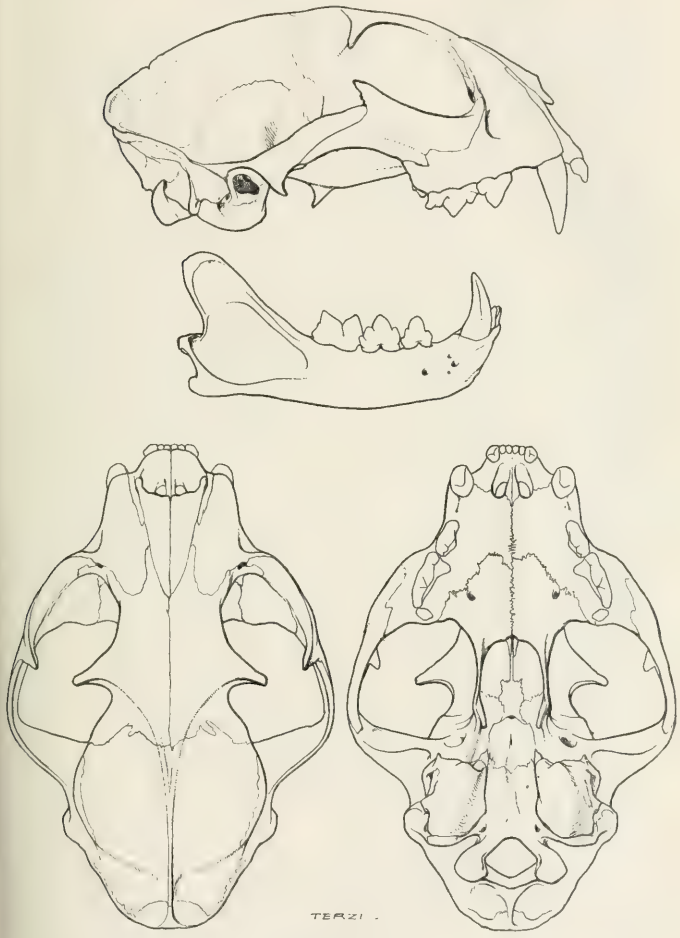

FIG. 99.
Lynx lynx. × ½.

and relatively wider interorbital region (interorbital breadth fully equal to diameter of orbit); the zygomata are, however

somewhat less abruptly spreading. Dorsal profile convex throughout, somewhat more so in front than behind, essentially as in *Felis silvestris*. Other general features so nearly as in the wild cat as to require no detailed description. A few details, however, are peculiar. Auditory bullæ relatively smaller than in *Felis silvestris*, the space between them fully as wide as bulla, the surface less closely applied to mastoid and paroccipital processes. Postorbital process seldom, if ever, becoming ligulate, the apex remaining sharply pointed. Anteorbital foramen about as large as in *Felis silvestris*, therefore relatively smaller, its position slightly more posterior, over posterior root of pm^3 or space between roots of pm^3 and carnassial. Nasal branch of premaxillary very narrow, its width at front of nasal barely one-fifth that of nasal in same region. Incisive foramina opposite middle of canine, their anterior border not reaching level of space between canines and incisors. Lateral emargination of posterior border of palate very slight, extending scarcely to level of front of molar. External pterygoid process reduced to a mere ridge. Mandible with coronoid process relatively shorter than in *Felis silvestris*, the distance from alveolus of molar to extremity of process about equal to that from back of molar to middle of canine; angular process rather noticeably bent inward.

Teeth.—In general structure, number and arrangement of cusps the teeth exactly resemble those of *Felis silvestris*, except that the posterior border of m_1 is distinctly oblique and armed with a minute though evident basal cusp slightly above the rudimentary cingulum. All the cheek-teeth are relatively longer, lower, wider, and less trenchant than in the wild cat, and the cingulum at posterior border of lower premolars is frequently less distinct, scarcely forming a cusp.

Measurements.—Adult from Valais, Switzerland (skin): head and body, 800±; tail, 110±; pencil, 30. For cranial measurements see Table, p. 478.

Specimens examined.—Thirteen, from the following localities:—
NORWAY: No exact locality, 3.
SWEDEN: No exact locality, 2 (B.M. and U.S.N.M.).
LAPLAND: No exact locality, 1 (Genoa).
SWITZERLAND: Near Geneva, 3 (Geneva); Alpes Vaudoises, 1 (Geneva); Valais, 1 (Geneva).
ITALY: Piedmont Alps, 2 (Genoa).

Remarks.—The material seen is insufficient to form the basis of any discussion of the local races of the European Lynx.

1.	Sweden.	Purchased. (*Brandt.*)	51. 11. 8. 16.
st.	Norway.	Zoological Society's Museum.	55. 12. 24. 273.
1.	Norway.	Zoological Society's Museum.	58. 5. 4. 63.
1.	Norway.	Zoological Society's Menagerie.	69. 10. 19. 16.

LYNX PARDELLUS Miller.

1827. *Felis pardina* Temminck, Monogr. de Mamm., I, p. 116 (Near Lisbon, Portugal). Not *Lynx pardina* Oken, 1816.

1907. *Lynx pardella* Miller, Ann. and Mag. Nat. Hist., 7th ser., XX, p. 398, November, 1907 (Coto Doñana, Huelva, Spain). Type in British Museum.

1910. *Lynx* (*Eucervaria*) *pardella* Trouessart, Faune Mamm. d'Europe, p. 105.

Type locality.—Coto Doñana, Huelva, Spain.

Geographical distribution.—Iberian Peninsula.

Diagnosis.—Length of lower cheek-teeth together about 30 mm.; skull relatively short and deep, the interorbital convexity conspicuous and abrupt; back and sides always densely spotted; cheeks noticeably whiskered.

External characters.—Form less robust than in *Lynx lynx*, but not differing in essential details. Underfur not densely woolly. Elongated hairs on sides of head below ears forming conspicuous pointed tufts 50 to 80 mm. in length, separated from each other along median line by a narrow area of ordinary fur.

Colour.—Underfur pale buff at base, the hairs becoming pale, dull tawny on distal half. Longer hairs buffy at base, black at tip, each with a whitish sub-terminal annulation about 5 mm. long. Ground colour above a fine mixture of the whitish and dull tawny, very uniform throughout body, neck, outer surface of fore leg and entire hind leg. On face it becomes greyish, and on feet there is usually a wash of cream-buff. In the more usual type of coloration the entire back and sides are closely sprinkled with rounded black spots, mostly about 10 mm. or less in diameter, the spots tending to become confluent so as to suggest two longitudinal dorsal stripes, and also though less clearly several transverse stripes on sides and shoulders. Although it is impossible to count the spots along back, there are evidently more than twenty-five between base of tail and most distinctly indicated transverse stripe on shoulder. On legs the spots become slightly larger, and on neck smaller and less distinct. In a less usual colour phase the spots are much larger and less numerous, many of those on back 20 mm. in diameter, the number between tail and most distinct shoulder stripe only about a dozen. Underparts creamy-white, heavily blotched with black on belly; throat more buffy, its spots very small; interramial space nearly white. A V-shaped black mark, open in front, extends from hinder portion of interramial space to ends of whiskers. Inner surface of fore legs like chest; a heavy black band at elbow and a faint one at wrist and at middle of upper arm. Whiskers mixed black and white. Ear and its long pencil black, the conch buffy along the anterior rim and at base, the posterior rim greyish at base, then with a black line 5 mm. wide parallel to edge. A broad, sub-triangular grey area on back of ear. Inner surface clothed

with long creamy-white hairs. Tail like back above, clear, light buffy below, the entire tip (about 40 mm.) black; a few black spots on upper surface which tend to arrange themselves in three transverse bands.

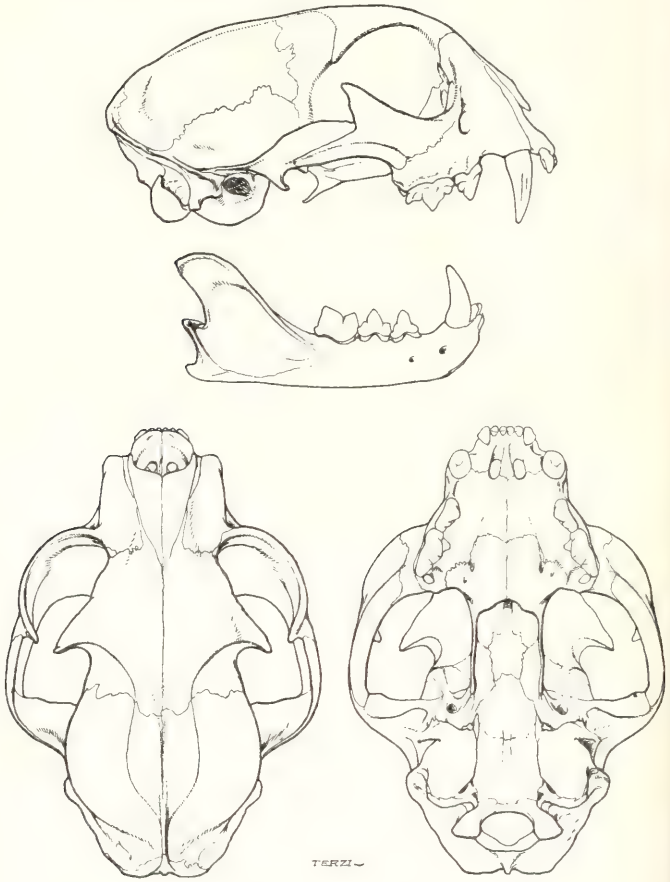

FIG. 100.
Lynx pardellus. × ½.

Skull.—The skull of *Lynx pardellus* differs conspicuously from that of *L. lynx* and *Felis silvestris* in the high, flattened inter-orbital region and anterior portion of brain-case, and abruptly

sloping rostrum, the two surfaces forming an evident angle in dorsal profile ranging from 40° to 50°. Aside from this very noticeable peculiarity in general form the skull agrees with that of *L. lynx* in all of the special features in which the latter differs from that of the wild cat. The ridge representing the external pterygoid process appears to be somewhat better developed, however, than in *L. lynx*. Temporal ridges rarely if ever uniting to form a sagittal crest in front of region of interparietal.

Teeth.—The teeth are intermediate in form between those of *Lynx lynx* and *Felis silvestris*. Cingulum at posterior border of lower premolars obsolete as in *L. lynx*, but posterior border of m_1 nearly as vertical as in *Felis silvestris*, and without secondary cusp or evident cingulum. Crowns relatively a little narrower and more trenchant than in *Lynx lynx*, but less so than in the wild cat, their length relatively as great as in the lynx.

Measurements.—Two males from Coto Doñana, Huelva, Spain (skins): head and body, 880 and 930; tail, 125 and 130; hind foot, 170 and 180; ear from meatus, 73 and 80; pencil, 30 and 55. For cranial and dental measurements see Tables, pp. 478, 479.

Specimens examined.—Eighteen, from the following localities in Spain: Old Castile, no exact locality, 1; Sierra Morena, Cordova, 3; near Seville, 3; Jerez de la Frontera, 1; Coto Doñana, 8; Andalucia, no exact locality, 1; no exact locality, 1.

Remarks.—Specimens in the two colour phases differ so noticeably from each other as to suggest the existence of distinct forms; and as yet I have seen no skins which could not at once be referred to one or the other. The two occur together, however, and there are no correlated peculiarities in the skulls and teeth.

♀.	Old Castile, Spain.	Lord Lilford (P).	94. 6. 11. 1.
1.	Sierra Morena, Cordova.	Capt. S. E. Widdrington (C & P).	42. 2. 26. 1.
2 ♂.	Sierra Morena, Cordova.	Lord Lilford (P).	89. 8. 27. 1. 94. 6. 11. 1.
1.	Seville.	Lord Lilford (P).	74. 10. 7. 1.
♂.	Seville. (*Dr. A. Ruiz.*)	Lord Lilford (P).	95. 9. 4. 1.
1.	Jerez de la Frontera.	A. Williams (C & P).	7. 12. 10. 1.
2.	Coto Doñana, Huelva.	J. P. Gassiot (C & P).	72. 10. 26. 1–2.
head, st.	Coto Doñana, Huelva.	A. Williams (C & P).	3. 3. 16. 1.
2 ♂, 2 ♀.	Coto Doñana, Huelva.	A. Chapman (C & P).	4. 12. 12. 1–2. 8. 3. 8. 2–3. (4. 12. 12. 2. *Type* of species.)
1.	Coto Doñana, Huelva.	B. F. Buck (C & P).	7. 6. 4. 2.
st.	Andalucia.	B. F. Buck (C & P).	6. 9. 16. 1.
1.	Spain.	Lord Lilford (P).	74. 9. 4. 1.

Note.—A lynx from Nuoro, Sardinia, has recently been described by Mola (Boll. Soc. Zool. Ital., Roma, 2d ser., IX, p. 48, 1908) as *Lynx sardiniæ*. The more important characters

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Postorbital constriction.	Interorbital constriction.	Rostral breadth over canines.	Depth of brain-case.	Palatal depth.	Rostral depth behind canine.	Mastoid breadth.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
Lynx lynx.															
Sweden . . .	1034 U.S.N.M.	♂?	143·8	104·6	37·8	35·0	43·8	49·4	48·8	31·6	69·0	108·4	51·2	58·8	?
,, . . .	B.M.	juv.	108·0	82·4	40·0	23·4	33·4	43·0	39·0	21·4	55·0	79·0	42·0	47·4	Teeth not worn.
Switzerland . .	618. 58 Geneva	♂?	143·0	110·8	40·0	35·8	41·2	45·0	43·0	21·0	54·0	109·0	49·0	57·4	,, slightly worn.
,, . .	223. 37 Geneva	♀?	129·0	100·0	40·0	32·0	40·0	47·0	45·5	22·0	60·5	—	45·0	—	,, not worn.
,, . .	603. 64 Geneva	juv.	109·0	84·4	45·0	25·0	36·4	45·5	43·2	22·0	55·5	79·8	41·0	47·0	,, ,,
Lynx pardellus.															
Spain: Old Castile .	94. 6. 11. 1	♀	—	91·0	41·6	27·6	32·0	45·0	42·4	26·0	56·0	82·4	33·0	42·4	,, ,,
Sierra Morena	89. 8. 27. 1	♂	—	—	—	—	—	—	—	—	—	89·8	40·0	46·6	,, ,,
near Seville .	95. 9. 4. 1	♂	120·0	92·0	42·0	31·2	35·0	47·0	45·4	25·0	58·0	88·0	40·0	45·6	,, ,,
Jerez . .	7. 12. 10. 1	♂?	120±	94·6	42·8	31·8	33·8	—	44·2	26·0	57·2	89·0	39·2	43·2	,, slightly worn.
Coto Doñana .	72. 10. 26. 1	♂?	—	92·0	41·0	29·8	35·0	49·0	47·0	27·0	57·0	86·0	39·2	46·2	,, ,,
,, ,, .	7. 6. 4. 2	♂	—	96·0	41·4	31·0	36·0	47·0	45·6	28·0	59·0	91·0	40·4	46·6	,, ,,
,, ,, .	8. 3. 8. 2	♂	127±	99·8	38·4	30·4	39·0	—	48·8	27·2	62·0	92·2	42·2	49·2	,, ,,
,, ,, .	4. 12. 12. 2*	♀	—	90·0	39·0	27·4	32·6	46·0	45·0	25·0	56·0	82·0	39·0	43·6	,, ,,
,, ,, .	8. 3. 8. 3	♀	115·2	92·2	43·2	31·0	35·0	—	43·0	26·4	57·0	85·0	38·8	44·2	,, ,,
,, ,, .	152619	♂	—	97·0	42·4	32·2	38·2	—	49·6	—	60·8	92·2	41·0	46·8	,, ,,

* Type.

DENTAL MEASUREMENTS OF *LYNX LYNX* AND *L. PARDELLUS.*

Locality.	Number.	Sex.	Upper carnassial.	Pm^3 and pm^4 together.	Lower cheek-teeth.	Lower carnassial.
Lynx lynx.						
Sweden . . .	1034 U.S.N.M.	♂?	18·6	30·8	37·6	16·0
,, . . .	B.M.	juv.	—	29·0	—	15·6
Switzerland . .	668. 32 Geneva	♂?	19·4	31·0	37·2	15·0
,, . .	223. 37 Geneva	♀?	18·6	29·4	—	—
,, . .	603. 64 Geneva	juv.	17·0	—	—	14·0
Lynx pardellus.						
Spain: Old Castile .	94. 6. 11. 1	♀	14·4	23·8	27·0	12·4
Sierra Morena	42. 2. 26. 1	juv.	15·4	26·0	30·8	13·6
,, ,,	89. 8. 27. 1	♂	16·0	26·2	30·8	13·0
near Seville .	95. 9. 4. 1	♂	14·8	25·0	30·0	12·8
Jerez . .	7. 12. 10. 1	♂?	14·0	23·6	28·4	12·4
Coto Doñana .	72. 10. 26. 1	♂?	14·6	24·4	29·6	12·8
,, ,, .	7. 6. 4. 2	♂	14·4	24·0	28·8	11·8
,, ,, .	8. 3. 8. 2	♂	16·0	27·0	32·6	13·8
,, ,, .	4. 12. 12. 2*	♀	15·0	25·0	29·2	12·2
,, ,, .	8. 3. 8. 3	♀	14·2	24·2	28·8	12·4
,, ,, .	152618	♂?	14·6	24·6	28·8	12·8
,, ,, .	152619	♂	16·2	26·4	30·8	13·4

* Type.

mentioned are as follows: Length of head and body, 1000 mm., tail, 330; height, about 350; cheeks distinctly whiskered, and ears tufted; back reddish, the dorsal area almost forming a band (fascia); sides reddish grey; head, neck, shoulder and flanks with reddish brown or greyish brown spots; legs with transverse tawny (fulvo) stripes; tail with black tip and three black sub-terminal rings; head with black stripe on each side beginning at mouth (fauci) and passing back through eye to side of neck; ear tawny inside, reddish outside; tending toward black below, the pencil (about 30 mm. long) reddish tending toward black; underparts and inner surface of legs dirty white with a reddish tinge.

Order **RODENTIA.**

1758. *Glires* Linnæus, Syst. Not. I, 10th ed., p. 56 (part).
1827. *Rodentia* Griffith, Cuvier's Animal Kingdom, Mamm., III, p. 61.

Geographical distribution.—Continents and larger islands of the entire world, New Zealand and the Antarctic excepted.*

Characters.—Terrestrial (occasionally semi-aquatic) placental mammals, incapable of true flight (a parachute-like membrane present in certain groups); feet unguiculate; dentition consisting of $\frac{1-1}{1-1}$ functional scalpriform incisors (a second pair of minute, terete, non-trenchant incisors present in upper jaw in the *Duplicidentata*) growing from a persistent pulp, and a row of from two to six tuberculate or laminate cheek-teeth, the crowns of which show no distinct traces of tuberculo-sectorial structure; canines absent; a wide diastema between incisors and cheek-teeth.

Remarks.—The members of the order *Rodentia* are immediately recognizable by the peculiarities of their dentition, no near approach to which is found in any other group of living mammals. They are all relatively small animals, the largest member of the group, the South American *Hydrochœrus hydrochœris*, attaining a weight of only about 50 kg., while the largest European species, the beaver, is less than half this size. In structure they show variety exceeded by the *Insectivora* only, while in number of genera and species they far surpass all other groups of mammals. About thirty families are recognized among living rodents, eleven of these occur in Europe.

KEY TO THE EUROPEAN FAMILIES OF *RODENTIA*.

Upper incisors 2–2, the enamel extending to posterior surface; incisive foramina very large, confluent; bony palate much shorter than mesopterygoid space; fibula articulating with calcaneum (Hares and Rabbits)..... *Leporidæ*, p. 484.

Upper incisors 1–1, the enamel confined to the front surface; incisive foramina moderate or small, distinct; bony palate longer than mesopterygoid space; fibula not articulating with calcaneum.

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* Members of the genera *Mus* and *Oryctolagus* are now artificially established on many of the remote islands from which the order was naturally absent.

Anterior portion of zygomatic arch formed chiefly by the jugal bone; infraorbital foramen small.
- Skull without postorbital processes; molars rootless; tail broad and flat (Beavers) ..... *Castoridæ*, p. 947.
- Skull with postorbial processes; molars rooted; tail terete.
  - Fore and hind leg not joined by a fold of skin (Squirrels) ..... *Sciuridæ*, p. 897.
  - Fore and hind leg joined by a fold of skin acting as a parachute (Flying Squirrels). *Petauristidæ*, p. 940.

Anterior portion of zygomatic arch not formed chiefly by the jugal bone; infraorbital foramen large.
- Jugal bone not supported by long zygomatic process of maxillary: mandible with angular part arising from outer side of alveolus of incisor; tibia and fibula distinct; body covered with long quills (nasal and frontal regions of skull in European genus conspicuously inflated) (Porcupines) ..... *Hystricidæ*, p. 542.
- Jugal bone supported by long zygomatic process of maxillary; mandible with angular part arising from under side of alveolus of incisor; tibia and fibula joined; body not covered with quills.
  - Lachrymal and malar bones in contact; anteorbital foramen much wider below than above, its inner border with conspicuous, nearly closed secondary canal ..... *Zapodidæ*, p. 535.
  - Lachrymal and malar bones not in contact; anteorbital foramen not wider below than above, its inner border without secondary canal.
    - External form excessively modified for underground life; skull wedge-shaped, the supraoccipital sloping forward to middle of brain-case, its area much greater than that of parietals (Mole-rats) ..... *Spalacidæ*, p. 887.
    - External form not specially modified for underground life; skull not wedge-shaped, the supraoccipital vertical or nearly so, confined to back of brain-case, its area much less than that of parietals.
      - Cheek-teeth (in European genera) $\frac{4}{4}$; cæcum absent (Dormice) ..... *Muscardinidæ*, p. 549.
      - Cheek-teeth (in European genera) $\frac{3}{3}$; cæcum present ..... *Muridæ*, p. 591.
        - Molars prismatic, hypsodont, usually rootless, their crowns flat (Voles and Lemmings) ..... *Microtinæ*, p. 610.
        - Molars tuberculate, brachyodont, rooted.
          - Tubercles on crowns of upper molars arranged in two longitudinal series ..... *Cricetinæ*, p. 592.
          - Tubercles on crowns of upper molars arranged in three longitudinal series ..... *Murinæ*, p. 791.

ARTIFICIAL KEY TO EUROPEAN MEMBERS OF RODENT FAMILIES.

(Based exclusively on the teeth.)

Incisors $\frac{2-2}{1-1}$; cheek-teeth $\frac{6-6}{5-5}$ ..... *Leporidæ*, p. 484.
Incisors $\frac{1-1}{1-1}$; cheek-teeth not more than $\frac{5-5}{4-4}$.
  Cheek-teeth $\frac{5-5}{4-4}$.
    Crowns of mandibular cheek-teeth with conspicuous median concavity ..... *Sciuridæ*, p. 897.
    Crowns of mandibular cheek-teeth without conspicuous median concavity..... *Petauristidæ*, p. 940.
  Cheek-teeth less than $\frac{5-5}{4-4}$.
    Cheek-teeth $\frac{4-4}{4-4}$.
      Cheek-teeth brachyodont, rooted ..... *Muscardinidæ*, p. 549.
      Cheek-teeth hypsodont, rootless.
        Enamel foldings transverse only..... *Castoridæ*, p. 947.
        Enamel foldings transverse, oblique and longitudinal..... *Hystricidæ*, p. 542.
    Cheek-teeth less than $\frac{4-4}{4-4}$.
      Cheek-teeth $\frac{4-4}{3-3}$..... *Zapodidæ*, p. 535.
      Cheek-teeth $\frac{3-3}{3-3}$.
        Enamel foldings sigmoid ..... *Spalacidæ*, p. 887.
        Enamel foldings not sigmoid..... *Muridæ*, p. 591.
          Cheek-teeth hypsodont, prismatic..... *Microtinæ*, p. 610.
          Cheek-teeth brachyodont, tubercular.
            Tubercles of upper molars arranged in two main rows ..... *Cricetinæ*, p. 592.
            Tubercles of upper molars arranged in three main rows..... *Murinæ*, p. 791.

Sub-Order **DUPLICIDENTATA.**

1811. *Duplicidentata* Illiger, Prodr. Syst. Mamm. et Avium, p. 91

Geographical distribution.—Essentially that of the order *Rodentia* except that it does not include Madagascar or Australia. One genus now almost universally distributed in the warmer portions of both hemispheres as the result of artificial introduction.

Characters.—Upper incisors 2–2, their enamel covering extending to posterior surface, the second tooth minute, subterete, without cutting edge; distance between mandibular tooth-rows much less than that between maxillary tooth-rows, only one pair of rows capable of opposition at the same time, the motion of the jaws in mastication consequently lateral; premolars $\frac{3-3}{2\ 2}$; incisive foramina very large, confluent posteriorly; bony palate reduced to a narrow bridge lying mostly between the premolars; facial portion of maxillary cribriform or incomplete; fibula articulating with the calcaneum.

Remarks.—The well defined sub-order* *Duplicidentata* contains

* Not improbably an order distinct from the Rodentia, as there is reason to believe that the resemblances between the two groups are the result of convergence rather than of relationship.

two families, the *Leporidæ* and *Ochotonidæ*. Only the former, including the hares and rabbits, is represented in Europe.

Family LEPORIDÆ.

1821. *Leporidæ* Gray, London Med. Repos., xv, p. 304, April 1, 1821.
1857. *Leporina* Blasius, Säugethiere Deutschlands, p. 409.
1897. *Lagidæ* Schulze, Helios, xiv, p. 82.

Geographical distribution.—As in the sub-order *Duplicidentata*.

Characters.—Palatal bridge formed chiefly by the maxillary bone; supraoccipital processes present; auditory bullæ rather small, not inflated with spongy tissue; clavicle rudimentary; hind legs elongated.

Remarks.—The members of the family *Leporidæ* are now arranged in ten genera,* two of which occur in Europe.

KEY TO THE EUROPEAN GENERA OF *LEPORIDÆ*.

Mesopterygoid region narrow, the width of space immediately behind palate much less than least longitudinal diameter of palate; postorbital processes (except in domestic races) slender, not distinctly triangular in outline (Rabbits)..... *Oryctolagus*, p. 484.

Mesopterygoid region broad, the width of space immediately behind palate greater than least longitudinal diameter of palate; postorbital processes robust, their outline distinctly triangular (Hares) *Lepus*, p. 495.

Genus **ORYCTOLAGUS** Lilljeborg.

1758. *Lepus* Linnæus, Syst. Nat., i, 10th ed., p. 57 (part).
1857. *Lepus* Blasius, Säugethiere Deutschlands, p. 410 (part).
1867. *Cuniculus* Gray, Ann. and Mag. Nat. Hist., 3rd ser., xx, p. 225 (Not of Brisson, 1762, or Wagler, 1830). Sub-genus of *Lepus*.
1874. *Oryctolagus* Lilljeborg, Sveriges og Norges Ryggradsdjur, i, p. 417 (Sub-genus of *Lepus*).
1899. *Oryctolagus* Major, Trans. Linn. Soc., London, 2nd ser., Zool., vii, p. 514, November, 1899. Genus (part).
1904. *Oryctolagus* Lyon, Smithsonian Miscell. Coll., xlv, p. 402, June 15, 1904 (Genus).

Type species. -*Lepus cuniculus* Linnæus.

Geographical distribution.—Northern Africa and southern and central Europe; now artificially introduced and established in many portions of the warmer region of both hemispheres.

Characters.—Externally similar to *Lepus*, but young at birth, blind and essentially naked. Skull differing from that of *Lepus* in the slender, never distinctly triangular postorbital process,

* For the most recent general work on the classification of the group see Lyon: Classification of the Hares and their allies. Smithsonian Miscell. Coll., xliv, pp. 321–447, June 15, 1904.

the posterior limb of which (except in certain domestic forms) is always free from cranium, persistence of sutures surrounding interparietal, and the strongly narrowed choanæ, the width of which, immediately behind palate, is noticeably less than least length of palate. Teeth essentially as in *Lepus*, but incisors both above and below less deeply implanted, and course of root of upper tooth not visible on outer surface of premaxillary. Cheek-teeth consisting of enamel cylinders filled with cement and dentine. In m^3 the cylinder is simple, its cross-section elliptical. In the anterior upper premolar it is also simple, but the anterior border is indented by longitudinal grooves appearing as re-entrant angles on worn surface of crown. In all the other cheek-teeth the cylinder is divided into two sections by a re-entrant fold arising from inner side of maxillary teeth and from outer side of mandibular teeth, in the former nearly crossing the crown, in the latter completely crossing it, though the two sections remain joined at their inner extremities except in m_3, in which they are distinct throughout ; * anterior section of first lower premolar indented by longitudinal grooves on its anterior surface.

Remarks.—The genus *Oryctolagus* contains the domestic rabbits and the wild rabbit of central and southern Europe. In addition to the more technical characters of the group its members are readily distinguishable from the other *Leposidæ*, with which they are naturally associated, by the blind, helpless condition of the young at birth.†

ORYCTOLAGUS CUNICULUS Linnæus.

(Synonymy under subspecies.)

Geographical distribution.—Northern Africa and southern and central Europe, the details of distribution considerably modified by human agency.

Diagnosis.—Size smaller than in the European species of *Lepus* (the Sardinian *Lepus mediterraneus* excepted), the hind foot in dry specimens seldom exceeding 90 mm., the occipito-nasal length of skull in largest individuals seldom more than 80 mm., ear from crown (dry) usually 70 to 80 mm., tail, including pencil, about as long as hind foot, its under surface and edge white, its upper surface blackish, usually grizzled with light brown ; general colour above a grizzle of black and light brown ; a distinct, dull buffy nape patch ; ear essentially concolor with back though more finely grizzled, without distinct colour pattern, the outer surface narrowly edged with black at tip ; underparts

* The structure of the teeth may be most clearly understood by examining the roots.

† This character recurs in the American *Sylvilagus* and perhaps also in some of the less known genera.

and inner surface of legs whitish except for dark inguinal patches and collar.

External characters.—The external form is typically leporine, the hind legs noticeably elongated, the ears long and the eyes large ; soles of feet covered by a dense brush of somewhat elongated and stiffened hairs which nearly conceal the large, nearly straight claws ; digits, 5–4 ; front foot with third digit longest, fourth and second successively shorter but not conspicuously so, fifth with tip of claw barely reaching base of claw of fourth, first much shorter than the others, only the claw projecting from integument of foot, its tip falling decidedly short of level of base of claw of fifth. Mammæ: p 1—1, a 2—2 = 6.

Colour.—Upper parts a coarse grizzle of cream-buff and black, the cream-buff in excess on sides, the black usually in excess on back, especially across loins. On rump the ground colour becomes paler and on outer surface of legs slightly darker and with an evident tinge of clay-colour, though in neither region forming any decided contrast with surrounding parts. On parting the fur of the back it is seen to have five colour bands : (1) a broad grey (about Ridgway No. 6) basal area (13 mm.), the extreme base somewhat paler ; (2) a brownish band (6 mm.) varying in exact colour between russet and light clay-colour and occupying terminal portion of underfur ; (3) blackish (2 mm.), not sharply defined below ; (4) cream-buff (3–4 mm.) ; (5) black (2–4 mm.), the last three occupying terminal portion of longer hairs. In addition to the underfur and ordinary longer hairs there are others about 40 mm. in length entirely black on back (except for grey basal area), and black with a cream-buff sub-terminal ring on sides. These longest hairs are never conspicuously different from the general fur as they are in *Lepus*. Nape patch a clear brown intermediate between russet and clay-colour. Head essentially like back but more finely grizzled, the cheeks not evidently different from back, the pale eyering barely indicated. No light spot between eye and muzzle or between eye and ear. Muzzle and region from which whiskers spring a clear dull buffy clay-colour, not strongly contrasted with rest of head. Ears not noticeably contrasted with head or back, their colour pattern nearly obsolete, though a faint trace of that so conspicuous in the hares is indicated by a slightly darker line along middle of posterior inner surface, and by a slight greyish tinge on basal half of posterior outer surface. The black tip is reduced to a mere ill-defined rim, sometimes obsolete and never more than 5 mm. wide, strictly confined to posterior surface. Collar and inguinal patches concolor with sides, the inguinal patches sometimes nearly meeting in median line. Rest of underparts together with inner side of legs buffy white or pale cream-buff. On hind legs the whitish area extends over dorsum of foot to extreme tip of toes, though sometimes suffused with the buffy brown of sides of feet. On

front legs it does not extend beyond wrist, the dorsal surface of which is occasionally marked with whitish or white.

Skull.—General form of skull slender, typically leporine, the rostrum produced, the occipital region strongly bent downward. Dorsal profile essentially straight from tip of nasals to front of brain-case, then slightly convex and strongly deflected to posterior edge of occiput; ventral profile nearly parallel to dorsal profile, but downward curve beginning further forward, about at level of anterior extremity of postorbital process; occiput flatly truncate at right angles with axis of brain-case, therefore obliquely to main axis of skull. Brain-case short-ovate in outline when viewed from above, its anterior extremity sharply defined by very deep postorbital constriction, its postero-lateral outline somewhat distorted by slightly projecting mastoid and auditory region. Interparietal rhomboidal or ligulate, its length usually about half width. No sagittal crest; lambdoid crest represented by a low ridge which curves abruptly backward at level of outer extremities of interparietal to form the outline of a sharply defined, somewhat elevated, bony shield lying on dorsal surface of supraoccipital and extending backward to edge of abrupt truncation; the general outline of this shield is squarish, but the posterior border is occasionally concave and the lateral borders may be convex. Posterior aspect of brain-case a broadly rounded arch slightly wider than high, the conspicuous, elongated paroccipital processes descending below level of lip of large foramen magnum, and closely applied to posterior surface of auditory bullæ. Floor of brain-case marked transversely by persistent suture between basioccipital and basisphenoid; behind this suture the basioccipital widens slightly, then narrows abruptly at front of condyles, its median region with wide longitudinal groove; auditory bulla flask-shaped, moderately inflated, with well developed straight neck, the main axis of bulla nearly parallel with posterior surface of occiput, though directed slightly outward, the sub-circular meatus plainly visible when viewed from above; transverse diameter of bulla about equal to that of basioccipital at region of greatest width between bullæ; height including tube nearly twice transverse diameter. Interorbital region flat, somewhat depressed, its width about equal to that of rostrum a little in front of middle; postorbital process slender, crescentic, bent downward at each extremity, the posterior limb decidedly longer than anterior limb though rarely coming in contact with brain-case; anterior limb occasionally fusing irregularly with frontal, zygoma rather slender, its upper edge narrow throughout and not flattened or everted along anterior half as is usually the case in the European species of *Lepus*. Rostrum slender, its depth to anterior rim of alveolus of first cheek-tooth noticeably less than distance from latter point to front of incisive foramen, nearly parallel-sided when viewed from the side, tapering slightly when viewed from above or

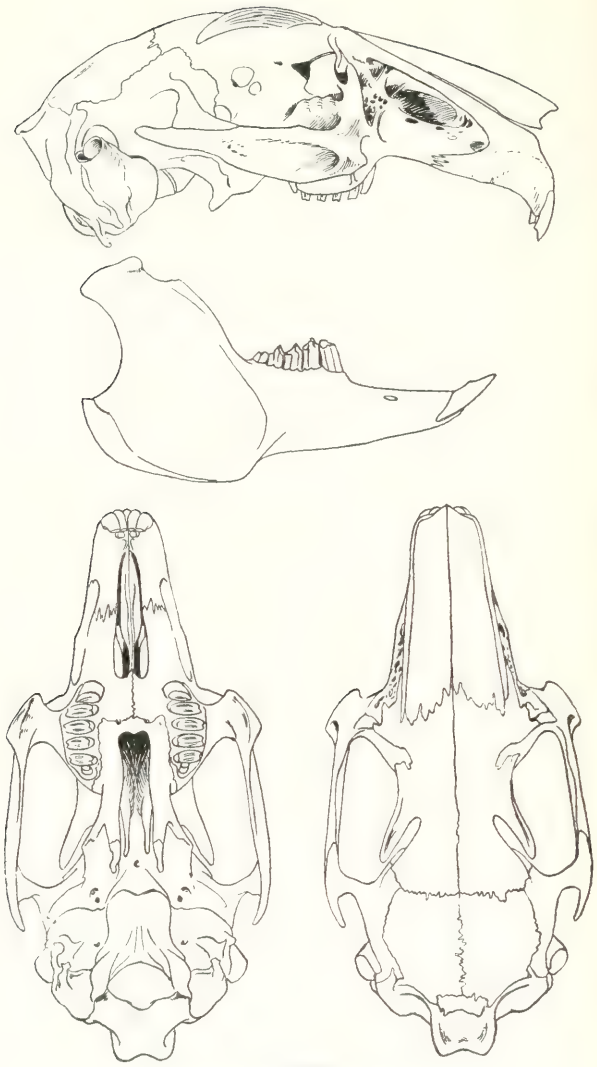

Fig. 101.

Oryctolagus cuniculus. Nat. size.

below ; nasals flattened posteriorly, convex laterally in front, their combined posterior margin deeply emarginate ; nasal branch of premaxillary extending nearly to posterior border of nasal. Outer margin of incisive foramen nearly straight, the outline of the two together narrowly cuneate, the greatest combined breadth about one-third length. Least longitudinal diameter of palate about two-thirds or three-quarters distance between alveoli of anterior premolars. External pterygoid plate well developed.

Teeth.—First upper incisor with root extending somewhat more than half way from aveolus to suture between premaxillary and maxillary, its course not distinctly indicated on outer surface of bone ; shaft of tooth about one-third greater in lateral diameter than in antero-posterior diameter, its section nearly a parallelogram in outline, though slightly wider internally than externally ; anterior face of tooth with deep, simple groove lying slightly nearer to internal than to external border ; posterior face with wide, shallow longitudinal concavity, the beveled edge abruptly angled near middle. Second incisor elliptical in cross section, flattened antero-posteriorly, the area of its shaft in cross section about one-sixth that of first tooth. Lower incisor with root extending back nearly or quite to level of front of alveolus of anterior molar, its shaft essentially like that of first upper incisor except that anterior groove and posterior concavity are absent and beveled edge is nearly flat Anterior upper premolar with crown narrowly elliptical in outline, the anterior border with three re-entrant angles, the second of which is deepest, usually extending to about middle of crown. Anterior lower premolar irregularly squarish in outline, narrower anteriorly than posteriorly, with two deep, rather wide grooves on outer side, a narrow re-entrant angle at middle of anterior border and a slight projection at middle of inner border ; anterior section of tooth decidedly larger than posterior section, its posterior enamel border forming a conspicuous, irregularly folded transverse ridge slightly behind middle of crown. Posterior upper molar essentially like second incisor. Posterior lower molar consisting of a larger elliptical, transversely flattened anterior section, and a smaller posterior subterete section, the enamel of each section forming a complete tube, the area of crown about one-third that of second molar. Second, third, fourth and fifth upper molariform teeth essentially alike, though slightly decreasing in size from before backward, the crown narrowly elliptical, the inner and outer margins notched or flattened (varying according to wear), the re-entrant enamel fold extending from inner border nearly across crown and dividing it into essentially equal halves, its anterior border crenulate. Second, third and fourth lower molariform teeth essentially alike in size and form, the crowns much longer than in the corresponding upper teeth, each consisting of two narrowly elliptical sections with very narrow, almost pointed extremities, the anterior section decidedly larger

than the posterior, the inner half of anterior border of smaller section broadly applied to middle of posterior border of larger section, the posterior enamel wall of anterior section forming a high, simple transverse ridge completely crossing crown.

Remarks.—The well-known European rabbit needs no special comparisons with other members of the fauna. In different parts of its range it is represented by two local races.

KEY TO THE SUBSPECIES OF *ORYCTOLAGUS CUNICULUS*.

Occipitonasal length of largest skulls, 78 to 82 mm.; hind foot, 83 to 93 mm. (Central Europe)..... *O. c. cuniculus*, p. 490.
Occipitonasal length of largest skulls, 71 to 77 mm.; hind foot, 72 to 82 mm. (Mediterranean region, Azores, &c.)..... *O. c. huxleyi*, p. 491.

Oryctolagus cuniculus cuniculus Linnæus.

1758. [*Lepus*] *cuniculus* Linnæus, Syst. Nat., I, 10th ed., p. 58.
1837. ? *Lepus vernicularis* Thompson, The Athenæum, p. 468. Nomen nudum (Ireland).
1843. ? *Lepus vermicula* Gray, List Spec. Mamm. Brit. Mus., p. 128. Nomen nudum.
1857. *Lepus cuniculus* Blasius, Säugethiere Deutschlands, p. 426.
1867. *Cuniculus fodiens* Gray, Ann. and Mag. Nat. Hist., 3rd ser., XX, p. 225, September, 1847 (Substitute for *cuniculus*). Type in British Museum.
1904. O[*ryctolagus*] *cuniculus* Lyon, Smithsonian Miscell. Coll., XLV, p. 406, June 15, 1904.
1910. *Oryctolagus cuniculus* Trouessart, Faune Mamm. d'Europe, p. 215.

Type locality.—Germany.*

Geographical distribution.—Central Europe north of the Mediterranean region; west to Ireland.

Characters.—Size large (occipitonasal length of largest skulls, 78 to 82 mm.; hind foot, 83 to 93 mm.); black of upper parts usually producing an evident clouded effect.

Measurements.—Adult male and female from Clandeboye, Belfast, Ireland: head and body, 420 and 408; tail, 47 and 63; hind foot, 87 and 85; ear, 68 and 65. Adult male and female from Tidmarsh, Berkshire, England: head and body, 408 and 392; tail, 63 and 64; hind foot, 92 and 86; ear, 70 and 70. Adult female from Lezayre, Isle of Man: head and body, 437; tail, 66; hind foot, 91; ear, 70. Two adult females from Ingelheim, Rheinhessen, Germany: head and body, 407 and 418; tail, 68 and 62; hind foot, 90 and 87; ear, 76 and 73. For craneal measurements see Table, p. 492.

Specimens examined.—Forty-six, from the following localities:—Ireland: Belfast, 3; Clandeboye, Belfast, 1; Dumdrum, Tipperary, 1; Kilmanock, Waterford, 2; no exact locality, 1 (skull).

* Based mainly on the domestic rabbit and on Gesner's account of the rabbit (wild and tame) of Germany. That the wild rabbit of Germany was considered by Linnæus as the typical animal is indicated by his statement: "Habitat in Europa australi."

SCOTLAND.—Shetland Islands, 1 (skull).

ENGLAND: Craigmoor, Isle of Man, 1; Lezayre, Isle of Man, 1; Kilnsea, Yorkshire, 1; Leeds, Yorkshire, 1 (U.S.N.M.); Sandringham, Norfolk, 2; Pangbourne, Berkshire, 2; Croydon, Surrey, 2; Orleston, Kent, 1; Kent, 1 (skull); Ditchling, Sussex, 4; Seatown, near Bridport, Sussex, 3; Ditchling, Sussex, 4; Tidmarsh, Berkshire, 2; near London, 1 (U.S.N.M.); Orleston, Kent, 1; Kent, no exact locality, 1 (skull); Barrow, Suffolk, 1 (U.S.N.M.); no exact locality, 1 (U.S.N.M.).

GERMANY: Ingelheim, Rheinhessen, 2; Strassburg, 2; south Germany, 3 (skulls).

Remarks.—The wild rabbit of Ireland, England and central Europe appears to be very constant in size, allowance being made for individuals that show evidence of crossing with domestic stock.

♂.	Belfast, Down, Ireland.	W. Thompson (P).	37. 7. 8. 25.
♂, ♀.	Belfast, Down.	Marquis of Dufferin and Ava (P).	5. 2. 22. 1–2.
♀.	Dumdrum, Tipperary.	Major P. J. Waldron (C & P).	5. 1. 15. 1.
♂, ♀.	Kilmanock, Waterford.	G. Barrett-Hamilton (P).	9. 12. 15. 5. 11. 1. 2. 109.
skull.	Ireland.	C. Darwin (P).	68. 2. 19. 92.
skull.	Shetland Islands, Scotland.	C. Darwin (P).	68. 2. 19. 96.
♀.	Lezayre, Isle of Man.	C. H. B. Grant (C & P).	11. 1. 3. 448.
♂, ♀ st.	Sandringham, Norfolk, England.	H.M. King Edward VII. (P).	96. 5. 9. 1–2.
skull.	Cambridgeshire.	J. Baker (P). (*Type* of *Cuniculus fodiens* Gray.)	519. c.
♂, ♀.	Pangbourne, Berkshire.	Sir James Clark, Bt. (C & P).	97. 2. 14. 1–2.
♂, ♀.	Croydon, Surrey.	C. H. B. Grant (C & P).	11. 1. 3. 398-399.
♂, 3 ♀.	Ditchling, Sussex.	Guy Dollman (C & P).	8. 9. 25. 1–4.
♂.	Orleston, Kent.	F. N. Garrard (C & P).	90. 1. 5. 1.
skull.	Kent.	C. Darwin (P).	68. 2. 19. 98.
2 ♀.	Ingelheim, Rheinhessen, Germany.	C. Hilgert (C).	8. 6. 15. 10–11.
3.	S. Germany.	Dr. A. Günther (C).	59. 9. 6. 44–46.

ORYCTOLAGUS CUNICULUS HUXLEYI Haeckel.

1874. *Lepus huxleyi* Haeckel, Hist. de la création des êtres organisés d'après les lois naturelles, p. 130 (Porto Santo).

1906. *Oryctolagus cuniculus cnossius* Bate, Proc. Zool. Soc., London, 1905, II, p. 322, April 5, 1906 (Dhia, off Candia, Crete). Type in British Museum.

1910. *Oryctolagus cuniculus cnossius* Trouessart, Faune Mamm. d'Europe, p. 215.

Type locality.—Island of Porto Santo, Madeira.

Geographical distribution.—Mediterranean region; introduced on the Azores, Madeira, and Salvage Islands, and probably elsewhere.

Characters.—Like *Lepus cuniculus cuniculus* but smaller (occipitonasal length of largest skulls, 71 to 77 mm.; hind foot, 72 to 82 mm.); ear relatively longer (equal to that of the larger

CRANIAL MEASUREMENTS OF *ORYCTOLAGUS CUNICULUS*.

Locality.	Number.	Sex.	Occipitonasal length.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Postorbital constriction.	Breadth of brain-case.	Nasal (diagonal).	Greatest breadth of both nasals together.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.
O. cuniculus cuniculus.														
Ireland: Co. Down . .	5. 2. 22. 1	♂	82·0	72·0	39·2	15·0	11·6	- -	37·0	15·0	23·2	63·4	15·0	15·4
England: Isle of Man . .	11. 1. 3. 448		82·0	72·4	39·0	15·0	14·0	27·1	38·0	17 2	24·0	62·0	15·6	16·2
Seatown, near Bridport . . .	153387		79·6	70·4	39·0	12·6	11·0	27·0	36·0	14·0	22·6	60·8	14·2	14·6
,, ,, .	153388		81·4	72·2	38·0	12·4	11·0	27·4	35·6	14·4	23·6	61·6	14·2	14·2
Tidmarsh, Berkshire . . .	97. 2. 14. 1	♂*	80·0	72·2	40·4	12·8	11·6	30·0	35·6	15·8	23·6	61·0	15·4	14·4
,, ,,	97. 2. 14. 2	♀*	80·4	70·4	39·0	14·6	13·0	29·0	38·0	16·0	22·4	61·4	14·6	15·2
Leeds . . .	3124 U.S.N.M.		80·0	72·4	39·6	13·6	11·4	28·8	36·2	15·2	23·6	62·2	14·8	15·0
near London . .	143675	♂	81·2	72·8	38 0	12·8	11·0	27·0	37·4	14·2	23·2	—	15·0	—
Barrow, Suffolk .	113257	♀	78·0	68·6	37·2	12·6	12·4	28·0	35·6	14·0	22·4	59·0	14·8	15·8
no exact locality .	49648		81·2	72·2	41·4	15·0	13·8	29·8	35·4	16·0	22·6	61·8	15·2	16·0
Germany: South Germany .	59. 9. 6. 45	♂	78·0	69·6	38·4	14·6	13 0	27·0	35·4	14·2	23·2	60·0	14·6	15·2
,, ,, .	59. 9. 6. 44		82·0	75·0	38·8	14·0	12·8	27·4	37·0	14·2	24·4	63·0	15·0	15·4
Ingelheim, Rheinhessen . .	8. 11. 2. 59	♀*	81·6	71·4	39·0	12·6	12·6	28·6	36·8	15·0	22·4	60·8	15·0	15·2
,, ,,	8. 11. 2. 60	♀	80·4	70·6	40·2	12·8	12·2	30·2	36·6	14·0	21·6	60·2	14·0	14·8
Strassburg . .	153389	♀	79·6	68·2	38·2	13·6	13·2	27·2	38·6	14·8	23·0	60·0	13·4	14·0
no exact locality .	45945		82·4	74·2	40·6	14·2	12·4	27·4	38·6	16·4	23·2	63·0	14·6	14·8

O. cuniculus huxleyi.														
Porto Santo	68. 2. 19. 104	*	—	66·4	37·0	13·0	11·8	27·0	—	—	22·0	52·0	13·8	14·0
,, ,,	68. 2. 19. 107	*	72·0	63·8	37·0	12·6	12·8	27·4	32·0	14·4	20·4	54·8	13·4	14·2
,, ,,	68. 2. 19. 111	*	72·0	62·4	37·0	13·4	12·2	28·4	32·2	15·4	20·0	54·0	13·0	14·0
Spain: Coto Doñana, Huelva	2. 3. 3. **2**	♂*	73·4	66·6	36·2	10·8	10·8	27·2	33·2	13·6	21·6	56·2	13·6	14·4
Seville	95. 3. 3. 15	♂	71·0	63·0	34·6	11·0	11·2	26·2	32·0	12·2	19·0	52·4	12·8	13·4
,,	95. 3. 3. 16		75·0	66·8	36·0	12·6	13·0	28·0	34·8	14·0	21·8	55·4	13·8	14·0
,,	95. 3. 3. 17	♀*	71·0	62·8	35·4	10·4	11·0	27·4	31·2	12·8	19·4	52·8	12·8	13·6
Silos, Burgos	8. 8. 4. 123	♀	77·6	67·4	37·0	10·6	10·4	28·0	35·4	12·8	20·8	56·2	13·0	14·0
Majorca, Balearic Islands	1. 3. 6. 3	♂*	72·0	65·0	36·4	11·8	11·4	27·0	32·0	13·4	20·4	54·0	13·0	13·8
,, ,,	1. 3. 6. 4	♂	72·6	64·6	37·0	12·2	11·6	29·0	31·4	13·2	20·0	55·0	13·4	14·4
,, ,,	1. 3. 6. 6	♀*	75·0	66·6	37·0	11·6	11·2	27·4	32·0	13·0	21·0	55·0	13·4	14·0
Minorca	0. 7. 1. 66	♂	75·0	68·0	40·0	11·8	10·4	29·2	33·6	14·8	23·6	54·2	13·6	13·2
France: near Nîmes, Gard	5479 Mottaz		76·0	67·6	38·0	11·4	12·6	28·0	33·4	13·0	21·6	57·0	13·6	14·0
,, ,,	5480 Mottaz		75·0	66·4	38·0	12·0	13·2	28·0	33·0	14·0	20·6	56 0	13·8	14·4
,, ,,	Hu. 52		77·6	68·0	38·6	11·6	11·0	29·0	35·6	13·0	20·2	58·0	13·4	13·6
Italy: Island of Capri	Genoa		75·0	67·6	—	12·6	12·0	27·0	31·4	13·0	20·0	—	13·0	13·6
,, ,,	,,		73·2	65·0	35·6	13·0	11·8	27·0	32·2	12·8	20·6	54·6	13·0	13·6
Crete: Dhia Island, off Candia	5. 12. 2. 35†	♀	74·0	66·0	36·4	11·0	10·2	27·0	33·0	13·4	20·0	54·0	13·4	14·8
Tunis	46. 11. 4. 4	*	73·4	65·0	37·6	11·4	11·2	27·2	31·4	13·6	20·0	55·6	12·6	14·0

* Old.

† Type of *cnossius* Bate.

animal); colour more finely grizzled, the back showing less tendency to be distinctly clouded with black.

Measurements.—Adult from Porto Santo: hind foot, 72. Two males from Terceira, Azores: hind foot, 73 and 76. Adult male from Seville, Spain: hind foot, 75; two females from the same locality: hind foot, 72 and 72. Adult male and female from Coto Doñana, Huelva, Spain: hind foot, 73 and 80. Adult male and female from San Cristobal, Minorca, Balearic Islands: head and body, 356 and 340; tail, 40 and 45; hind foot, 82 and 80; ear from crown, 70 and 70. Average and extremes of five males from Poulx, Gard, France: head and body, 371 (347–397); tail, 55 (45–63); hind foot, 77·8 (76–80·2). Adult female from Island of Dhia, off Candia, Crete (type of *cnossius*): head and body, 341; tail 65; hind foot, 77·6; ear, 70. For cranial measurements see Table, p. 493.

Specimens examined.—Seventy, from the following localities:—

Porto Santo: Five.

Azores: Terceira, 2; San Miguel, 4.

Spain: Coto Doñana, Huelva, 4; Seville, 4; Silos, Burgos, 3; Castrillo de la Reina, Burgos, 1; Selva, Majorca, Balearic Islands, 1; Inca, Majorca, 2; Alcudia, Majorca, 1; San Cristobal, Minorca, 2.

France: Poulx, Gard, 5; near Nimes, Gard, 14 (Mottaz); Digne, Basses-Alpes, 8 (Mottaz).

Italy: Island of Capraja, Genoa, 5 (B.M. and Genoa); Palermo, Sicily, 1 (U.S.N.M.).

Sardinia: Assuni, 7 (U.S.N.M.).

Crete: Dhia Island, off Candia, 1 (type of *cnossius*).

Remarks.—In colour the Mediterranean rabbit nearly agrees with the central European form, but when series of skins are compared it is at once seen that the smaller animal is the more grey and finely grizzled of the two, its back seldom distinctly clouded with black, a condition that is usual in true *cuniculus*. The actual elements of the colour are essentially the same in the two, but in *huxleyi* the sub-terminal annulations of the longer hairs are slightly paler than in the central form. Except for the differences in size the skull and teeth agree with those of the larger animal.

The failure to distinguish between this race and that of central Europe has been responsible for much speculation as to the probable origin within historic times of the small rabbits of Porto Santo, which happened to be compared by Darwin with British examples of true *cuniculus*. Some of Darwin's specimens from this island are still in the British Museum. As might have been anticipated they prove to be exactly similar to the common Mediterranean form.

5.	Porto Santo, Madeira Islands.	C. Darwin (P).	68. 2. 19. 93, 104, 107, 111, 117.
1.	San Miguel, Azores.	F. du Cane Godman (C & P).	73. 3. 21. 1.
♂, ♀.	San Miguel.	Major F. A. Chaves (C & P).	6. 3. 25. 1–2.

♀.	San Miguel.	Major F. A. Chaves (C & P).	6. 3. 25. 3.
2.	Coto Doñana, Huelva, Spain.	J. P. Gassiot (C & P).	72. 10. 26. 3–4.
♂, ♀.	Coto Doñana, Huelva.	A. Chapman (C & P).	2. 3. 3. 1.
2 ♂, 2 ♀.	Seville. (*Dr. A. Ruiz.*)	Lord Lilford (P).	95. 3. 3. 15–18.
1.	Silos, Burgos.	S. & N. Gonzalez (C).	8. 7. 7. 26.
♀.	Silos, Burgos.	G. S. Miller (C).	8. 8. 4. 123.
♀.	Castrillo de la Reina, Burgos.	G. S. Miller (C).	8. 8. 4. 122.
♂.	Selva, Majorca, Balearic Islands. (*M. Riutort.*)	O. Thomas (P).	1. 3. 6. 3.
2 ♀.	Inca, Majorca. (*M. Riutort.*)	O. Thomas (P).	1. 3. 6. 5 6.
♂.	Alcudia, Majorca. (*M. Riutort.*)	O. Thomas (P).	1. 3. 6. 4.
♂, ♀.	San Cristobal, Minorca.	O. Thomas and R. I. Pocock (C & P).	0. 7. 1. 66–67.
3 ♂, 1 ♀.	Poulx, Gard, France. (*C. Mottaz.*)	O. Thomas (P).	8. 8. 10. 135–138.
1.	Capraja Island, Tuscany.	Genoa Museum (E).	7. 2. 28. 4.
♀.	Island of Dhia, Crete.	Miss D. Bate (C). (*Type* of *O. cnossius* Bate.)	5. 12. 2. 35.

Genus **LEPUS** Linnæus.

1758. *Lepus* Linnæus, Syst. Nat., I, 10th ed., p. 57 (type by tautonymy, *L. timidus* Linnæus).

1828. ? *Lagos* Brookes, Catal. Anat. and Zool. Mus. of Joshua Brookes, p. 54 (Nomen nudum).

1829. *Chionobates* Kaup, Entw.-Geseh. u. Natürl. Syst. d. Europ. Thierwelt, I, p. 170 (*variabilis* and *borealis*).

1857. *Lepus* Blasius, Säugethiere Deutschlands, p. 410 (part).

1867. *Eulagos* Gray, Ann. and Mag. Nat. Hist., 3rd ser., XX, p. 222, September, 1867 (*mediterraneus* and *judææ*).

1899. *Lepus* Major, Trans. Linn. Soc., London, 2nd ser., Zool., VII, p. 514, November, 1899.

1899. *Eulepus* Acloque, Faune de France, Mammifères, p. 52 (*europæus* and *variabilis*).

1904. *Lepus* Lyon, Smithsonian Miscell. Coll., XLV, p. 389, June 15, 1904.

Type species.—*Lepus timidus* Linnæus.

Geographical distribution.—Europe, Asia, North America and Africa.

Characters.—Skull with bony palate short, its length at narrowest region never more than two and one-half times that of first upper molar; width of choanæ greater than least length of palate, and about four times that of first molar; sutures of interparietal obliterated in adult; postorbital processes broad and triangular, with distinct anterior and posterior limbs; first upper premolar with deep median re-entrant angle, on each side of which is a smaller re-entrant angle of varying depth; anterior portion of anterior lower premolar with a narrow re-entrant angle on its front face and a broad re-entrant angle on external aspect; second to fifth upper cheek-teeth alike, the re-entrant

angle extending from inner face about three-quarters of distance across crown, the adjacent edges of the fold closely approximated and finely crenulate; posterior section of second, third and fourth lower cheek-teeth about four-fifths as wide as anterior half; last upper molar a small elliptic cylinder; third lower molar with anterior segment elliptical in section, the posterior segment smaller and nearly terete, the enamel of the two cylinders normally separate throughout. Externally characterized by the soft pelage, well developed tail, and long feet heavily clothed with hair that nearly conceals the nails. Young at birth active, the eyes open, and the body completely furred.

Remarks.—As now restricted the genus *Lepus* contains about eighty named species. Eight of these occur in Europe, most of them represented by several geographic forms.

KEY TO THE EUROPEAN FORMS OF *LEPUS*.

Tail, including pencil, much shorter than hind foot, its upper surface white or clouded with brown or grey, never with clear black median area; zygoma relatively deep anteriorly, the distance from anterior termination of groove on outer surface to front edge less than least depth; root of upper incisor extending to suture between premaxillary and maxillary; pelage usually changing to white or whitish in winter (distribution northern and Alpine) Varying Hares.

General colour of upper parts in summer dull russet (approaching the wood-brown and russet of Ridgway); winter pelage never entirely white (Ireland)..... *L. hibernicus*, p. 531.

General colour of upper parts in summer greyish brown (approaching the broccoli-brown and hair-brown of Ridgway); winter pelage usually white or pale grey..... *L. timidus*, p. 522.

Occipitonasal length of adult skulls ranging from 95 mm. to 103 mm. (Scandinavian Peninsula) ..... *L. t. timidus*, p. 526.

Occipitonasal length of adult skulls ranging from 85 to 93 mm.

Ear from crown 80 to 90 mm. (Scotland) *L. t. scoticus*, p. 529.

Ear from crown 90 to 100 mm. (Alps) ..... *L. t. varronis*, p. 528.

Tail, including pencil, about as long as hind foot, its upper surface with conspicuous clear black median area; zygoma relatively shallow anteriorly, the distance from anterior termination of groove on outer surface to front edge usually equal to or greater than least depth; root of upper incisor not extending to suture between premaxillary and maxillary; pelage never changing to white and rarely to grey in winter (distribution central and southern) Ordinary Hares.

Hind foot less than 105 mm.; legs without white markings, the inner surface scarcely lighter than outer (Sardinia)..... *L. mediterraneus*, p. 513.

Hind foot more than 110 mm.; legs usually with white markings, the inner surface always noticeably lighter than outer.
Outer side of thigh much brighter than back, its colour often nearly the cinnamon-rufous of Ridgway; dorsal surface of foot and wrist marked with pure white..... *L. granatensis*, p. 515.
Ear from crown about 95 mm. (Basses-Pyrénées)..... *L. granatensis iturrissius*, p. 518.
Ear from crown, 105 to 115 mm.
Buffy tints pale, approaching the cream-buff of Ridgway (Central and southern Spain)..... *L. granatensis granatensis*, p. 516.
Buffy tints rich, approaching the ochraceous-buff of Ridgway (North-western Spain)..... *L. granatensis gallæcius*, p. 517.
Outer side of thigh not brighter than back, its colour ochraceous, buffy, or greyish; dorsal surface of foot and wrist without white markings.
Predominating brownish tints; rump usually bluish grey in strong contrast with back.
Rump scarcely greyer than back; black area on outer side of ear extending about 40 mm. below tip; skull with unusually slender rostrum (Parnassus region, Greece)..... *L. parnassius*, p. 519.
Rump noticeably greyer than back; black area on outer side of ear extending 20 to 30 mm. below tip; rostrum normal.
Size small, hind foot 119 to 126, occipitonasal length of skull 90 to 96 (Crete and Cephalonia) ..... *L. creticus*, p. 512.
Size medium or large.
Rump very conspicuously grey; hind foot 135 to 155 mm.; occipitonasal length of skull 97 to 105 mm. (Roumania to the Peloponesus)..... *L. europæus transsylvanicus*, p. 509.
Rump less conspicuously grey; hind foot 125 to 140 mm.; occipitonasal length of skull 95 to 103 mm. (South-eastern France to Corfu) *L. e. meridiei*, p. 506.
Predominating buffy tints; rump buff or buffy grey, scarcely or not contrasted with back.
Cheeks conspicuously whitish; general colour of upper parts a light cream-buff; size very large, hind foot about 155 mm. (Eastern Germany and eastward) ..... *L. e. hybridus*, p. 508.
Cheeks greyish or brownish; general colour never a light cream-buff; size large or medium, hind foot 113 to 147 mm.

Hind foot 121 to 147 mm.; occipito-nasal length of skull 93 to 102 mm. (Central).
Buffy tints rather pale, approaching the cream-buff of Ridgway (Germany, Denmark, France, except southern portion) ..... *L. e. europæus*, p. 502.
Buffy tints rich, approaching the ochraceous-buff of Ridgway (England) .. .. *L. e. occidentalis*, 504.
Hind foot 113 to 125 mm.; occipito-nasal length of skull 89 to 94 mm. (Southern).
Nape patch well differentiated; base of ear conspicuously buffy behind; underfur not yellowish (Pyrenees)..... *L. e. pyrenaicus*, 506.
Nape patch scarcely indicated; base of ear not conspicuously buffy behind; underfur yellowish (Corsica, Sicily, southern Italy) *L. e. corsicanus*, p. 507.

LEPUS EUROPÆUS Pallas.

(Synonymy under subspecies.)

Geographical distribution.—Central Europe from Great Britain to Russia and from the Baltic south to the Pyrenees, Italy and Greece.

Diagnosis.—Tail moderately long, its length including terminal hairs about equal to that of hind foot, its upper surface never white or grizzled, always with conspicuous black median area; ear long, extending decidedly beyond nostril when laid forward; general colour of upper parts a coarsely grizzled buffy or ochraceous brown; outer side of thigh not contrasting in colour with back; buffy and ochraceous tints occasionally replaced by pale smoke-grey in a rarely assumed, special winter pelage; ear with conspicuous black terminal area on outer surface; size rather large, the hind foot usually more than 130 mm., though less in some southern races; root of upper incisor short, not extending to suture between premaxillary and maxillary; height of posterior upper premolar measured from crown to upper surface of root capsule usually less than alveolar length of tooth-row.

External characters.—Except for the relatively longer limbs, ears and tail, the external form is essentially as in *Oryctolagus*. Digits similarly 5–4, their proportional lengths as in the smaller animal, but claws somewhat more flattened. Mammæ: $p\ 1-1$, $a\ 2-2=6$.

Colour.—Upper parts buffy, nearly clear on sides, underlaid with blackish on back, the two colours forming a coarse mixture varying considerably according to condition of pelage, but buffy normally in excess. On sides the black becomes less, disappearing entirely on legs, collar and along edge of white ventral area. Rump usually lighter than either back or sides, sometimes

conspicuously grey. Sides with evident though not very noticeable sprinkling of hairs 60–70 mm. in length, the basal half dark, the terminal half whitish. Tail white below and around entire edge,* the dorsal surface with a broad clear black median stripe. Nape clear buffy, with or without a greyish white suffusion. Head essentially like body but with the darker and lighter colours more finely blended. An evident (sometimes conspicuous) lighter area between eye and muzzle and another between eye and base of ear. A slightly defined grey eyering, below and behind which there is often a noticeable tawny area. An ochraceous or tawny spot at base of whiskers. Ear buffy (rather paler than buff of body) with the following colour-pattern : inner surface clear buffy sometimes tinged with grey, the buffy clearer and brighter just below terminal black rim, and much darker and somewhat grizzled over an area about 40 mm. long and 10 mm. wide along median portion of outer edge (though not involving extreme rim, which is very pale buff or even whitish from base to black terminal portion), the grizzled region further emphasized by a small pallid area at its inner base ; anterior outer surface a fine grizzle of the same elements as those of back, the edge conspicuously fringed with clear buffy except at black-rimmed tip ; posterior outer surface buffy at extreme base, grey or buffy grey at middle, and black at tip, the black area extending conspicuously below rim of ear and forming a definitely outlined patch 25–35 mm. long, and 10–15 mm. wide. Underparts, except collar, white, this colour extending to inner surface of legs, which, though occasionally much tinged with buffy, are always noticeably paler than outer surface (cf. *L. mediterraneus*). A clear buffy or ochraceous patch in inguinal region, the two patches sometimes meeting in median line. Feet buffy, darker on the toes, paler proximally, but never marked with pure white (cf. *L. granatensis*) ; soles an indefinite buffy grey.

The grey winter coat, when it occurs, differs from the usual pelage merely in the substitution of a light drabby grey for all the buffy and ochraceous tints, the black remaining unchanged. The colour pattern is therefore in no way modified, though the general appearance of the animal is so altered as to have given rise to the belief that individuals in this pelage represented hybrids between *Lepus europæus* and some form of varying hare.†

Skull.—The skull of *Lepus europæus* resembles that of *L. timidus* more closely than would be anticipated from the conspicuous external differences in the animals. Ordinarily they may be distinguished by size, as in *L. europæus* the occipitonasal length is usually more than 93 mm. (92 to 105 mm.), while in *L. timidus* (except in the large *L. t. timidus*) it is seldom more

* The absence of the white edging at tip of tail is nearly always an indication that the extremity has been broken off.

† Such individuals may be distinguished from hybrids by the length and colour of the tail, and by their cranial characters.

than 92 mm. (86 to 93 mm.). Brain-case relatively narrower and deeper than in *Lepus timidus*, and parietal region less flattened, the dorsal profile when viewed from behind arching abruptly and conspicuously above level of zygomatic roots. Anterior half of frontal nearly flat, the orbital rims rising slightly but abruptly above general level of interorbital region. Posterior extremity of malar and relative length of suture between malar and zygomatic process of squamosal as in *L. timidus*. Anterior portion of zygoma usually though not always differing from that

FIG. 102A.
Lepus europæus. Nat. size.

of *L. timidus* in the greater width and relatively less depth of the elevated region in front of lateral groove; the least distance from groove to anterior edge of zygoma usually equal to or greater than depth at same region. Auditory bulla relatively a little larger than in *Lepus timidus*, its ventral profile a little less convex and anterior border less rounded off, a peculiarity not easily described but which when once seen is readily appreciated.

Teeth.—In general the teeth resemble those of *Oryctolagus cuniculus*, differing in a few slight details only. Upper incisor with groove on anterior face decidedly nearer internal border

than external border ; posterior face with longitudinal concavity barely indicated ; root as short as in *Oryctolagus*, but whole course of tooth noticeably indicated on outer surface of bone. Anterior upper premolar with lateral re-entrant angles on anterior margin variable in development, one or both occasionally obsolete. Other maxillary teeth as in *Oryctolagus*, but posterior border of re-entrant fold sometimes crenulate ; roots of maxillary

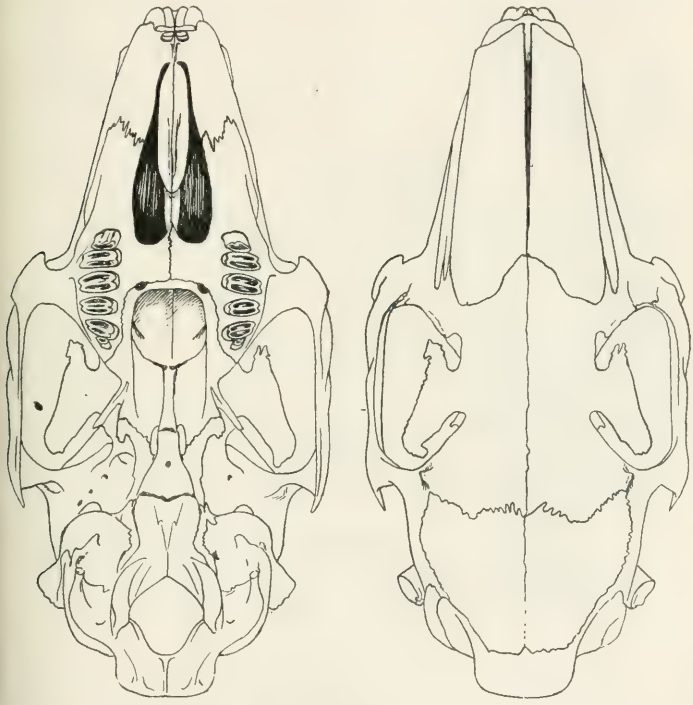

FIG. 102B.
Lepus europæus. Nat. size.

teeth not extending so far into orbit as in *Oryctolagus* and in *Lepus timidus*, the distance from crown of third premolar to upper surface of its root capsule usually less than alveolar length of tooth-row. Anterior lobe of anterior lower premolar usually narrower than in *Oryctolagus*, but broader than in *Lepus timidus* ; posterior section of this tooth as well as that of the succeeding molariform teeth (including m_3) relatively larger than in *Oryctolagus*.

Remarks.—*Lepus europæus* is readily distinguishable among the hares of continental Europe by its large size, long ear with distinct colour pattern on dorsal surface, absence of white markings on feet, and lack of noticeable contrast between colour of sides of body and outer surface of thigh. It is a plastic species, readily becoming differentiated into local races. Seven of these are now known to occur west of Russia.*

Lepus europæus europæus Pallas.

1777. *'Lepus' timidus* Erxleben, Syst. Regni Anim., I, p. 325 (Not of Linnæus, 1758).

1778. *Lepus europæus* Pallas, Nov. Spec. Quadr. Glir. Ord., p. 30 (Burgundy, France).

1783. *Lepus timidus* Schreber, Säugthiere, pls. CCXXXIIIA and CCXXXIIIB (Germany). Not of Linnæus, 1758.

1789. *Lepus europæus* Schreber, Säugthiere, IV, p. 865.

1801. *L[epus] t[imidus] albus* Bechstein, Gemeinn. Naturgesch. Deutschlands, I, 2nd ed., p. 1096 (Thüringen, Germany).

1801. *L[epus] t[imidus] flavus* Bechstein, Gemeinn. Naturgesch. Deutschlands, I, 2nd ed., p. 1096 (Thüringen, Germany).

1801. *L[epus] t[imidus] niger* Bechstein, Gemeinn. Naturgesch. Deutschlands, I, 2nd ed., p. 1097 (Thüringen, Germany).

1820. *Lepus medius* Nilsson, Skand. Fauna, I, p. 224 (Zealand, Denmark; based on specimens in grey winter pelage).

1857. *Lepus timidus*, b. Mitteleuropäische Form, Blasius, Säugethiere Deutschlands, p. 417.

1859. ? *Lepus campicola* Gervais, Zool. et Paléont. Francaises, 2nd ed., p. 47 (Nomen nudum based on the common hare of France).

1867. ? [*Lepus timidus*] *coronatus, rufus, cinereus, nigricans, maculatus, albus* and *niger* (Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LVI, p. 161 (Austria). Nomina nuda.

1875. [*Lepus timidus*] var. *argenteogrisea* König-Warthausen, Verzeichniss der Wirbelthiere Oberschwabens, Säugethiere, p. 85 (Ulm, Würtemberg, Germany). Probably based on an individual in grey winter coat.

1910. *Lepus europæus* and *L. medius* Trouessart, Faune Mamm. d'Europe, p. 219.

Type locality.—Burgundy, France.†

Geographical distribution.—Central Europe from Germany to

* The *Lepus europæus carpathorum* of Hilzheimer (Zool. Anzeiger, XXX, p. 512, August 14, 1906) from the Carpathians may represent an eighth race. The difficulty of clearly understanding the various local forms of European hares is greatly increased by the frequency with which the animals are transported from one region to another for the purpose of restocking exhausted hunting grounds. *L. e. transylvanicus* has thus been taken to Denmark, and *L. e. occidentalis* to Switzerland. Other instances of the same kind will undoubtedly be found.

† Pallas refers to Daubenton's account of this animal for measurements (Nov. Sp. Quadr. Glir. Ord., p. 2), and mentions no definite locality. Polonia and Pannonia are, he says (p. 5), inhabited by another form. Daubenton's description (Buffon, Hist. Nat., VI, pp. 264–299) was based on Burgundian specimens.

the Atlantic coast and from Denmark to central France. This is probably the form recently introduced in southern Sweden.

Diagnosis.—Buffy tints pale, approaching the cream-buff of Ridgway ; rump usually not grey, always with evident darker area continuous with black tail-stripe.

Colour.—Underfur (20 mm.) silvery white at base (occasionally with a slight buffy tinge), becoming abruptly dark sepia slightly beyond middle of hairs and blackish at extreme tips ; longer hairs (30 mm.) whitish at base, dark brown at level of dark portion of underfur, then with a cream-buff annulation 5–7 mm. long and a shorter blackish tip. Clear area along sides cream-buff, darkening to a light, yellowish ochraceous-buff in inguinal region and on outer side of fore leg. Collar light ochraceous-buff. Rump greyer than back, but usually so suffused with cream-buff as to form no marked contrast, its median area always slightly darker than lateral portions.

Skull and teeth.—In the typical race the skull attains nearly the maximum size for the species, the occipitonasal length frequently exceeding 100 mm., but apart from this, neither skull nor teeth show any special features worthy of note.

Measurements.—Two adult males and an adult female from Haslev, Zealand, Denmark : head and body, 660, 680 and 640 ; tail, 80, 82 and 74 ; hind foot, 136, 147 and 138 ; ear from crown (fresh) : 138, 131, and 125. Adult male from Ingelheim, Rheinhessen, Germany : head and body, 571 ; tail, 98 ; hind foot, 135 ; ear from crown (dry), 120. Two adult males from Rheinthal, St. Gallen, Switzerland : head and body, 570 and 570 ; tail, 100 and 85 ; hind foot, 136 and 137 ; ear from crown (dry), 117 and 115. Two adult females from Werdenberg, St Gallen, Switzerland : head and body, 600 and 605 ; tail, 90 and 95 ; hind foot, 145 and 144 ; ear from crown, 114 and 118 For cranial measurements see Table, p. 510.

Specimens examined.—Twenty-seven, from the following localities :—
DENMARK : Haslev, Zealand, 5 ; Zealand (no exact locality), 1.
BELGIUM : Slype, West Flanders, 1.
FRANCE : Near Paris, 1 ; Etupes, Doubs, 1 (Mottaz).
GERMANY : Brunswick, 3 ; Ingelheim, Rheinhessen, 1 ; Burg, near Magdeburg, 1 ; south Germany, 6 (skulls).
AUSTRIA-HUNGARY : Salzburg, 1 (U.S.N.M.).
SWITZERLAND : Flawil, St. Gallen, 1 (U.S.N.M.) ; Rheinthal, St. Gallen, 2 (U.S.N.M.) ; Werdenberg, St. Gallen, 2 (U.S.N.M.) ; Wittembach, St. Gallen, 1 (U.S.N.M.).

Remarks.—The typical form of *Lepus europæus* is characterized by large though not maximum size, and rather light, strongly yellowish colour. It is probably the most extensively distributed of the western European forms. The pale winter coat is occasionally assumed.

5.	Haslev, Zealand, Denmark.	O. Helms (c).	8. 2. 15. 1–5.
1.	Zealand.	Stockholm Museum (E).	46. 6. 2. 71.

1.	Slype, Flanders, Belgium.	Andrew van Iseghem (C & P).	2. 11. 3. 1.
♀.	Paris.	A. Forsyth Major (P).	97. 2. 19. 1.
3.	Brunswick, Germany.	G. Barrett-Hamilton (P).	8. 9. 29. 1–3.
♂.	Ingelheim, Rheinhessen. (*Hilgert.*)	G. Barrett-Hamilton (P).	11. 1. 2. 110.
6.	S. Germany.	Dr. A. Günther (C).	59. 9. 6. 38–43.

Lepus europæus occidentalis de Winton.

1898. *Lepus europæus occidentalis* de Winton, Ann. and Mag. Nat. Hist., 7th ser., I, p. 152, February, 1898. Type in British Museum.

1906. *L[epus] e[uropæus] occidentalis* Hilzheimer, Zool. Anzeiger, XXX, p. 512, August 14, 1906.

1910. *Lepus europæus occidentalis* Trouessart, Faune Mamm. d'Europe p. 220.

Type locality.—Herefordshire, England.

Geographical distribution.—England, the Isle of Man and the lower, more cultivated portions of Scotland, north to the Orkney and Shetland Islands, the northern limits of the range much extended artificially; introduced in Ireland* and Switzerland.

Diagnosis.—Similar to *Lepus europæus europæus*, but buffy tints rich and dark, approaching the ochraceous-buff of Ridgway.

Colour.—Underfur as in *L. europæus europæus*, except that the dark portion is more nearly black. Longer hairs with the black tips better developed and the sub-terminal annulations a dark ochraceous-buff, showing in certain lights a decided tinge of tawny. This tawny becomes clear and tinged with rufous along sides and on inguinal patches, though it is duller and with a decided clay-colour cast on collar. Rump as in *L. europæus europæus*. Grey winter pelage: all the buffy tints replaced by light grey, the exact shade of which is very uniform in the six specimens examined. It is somewhat paler than the smoke-grey of Ridgway and distinctly more blue, somewhat approaching the grey No. 7, though not so dark. A very slight cream-buff wash may be detected on cheeks, sides of neck and of shoulders, and on collar.

Skull and teeth.—The skull averages slightly smaller than in *L. europæus europæus*, the occipitonasal length rarely attaining 100 mm. The teeth, however, are fully as large as in the continental animal.

Measurements.—Two adults from the Isle of Man: head and body, 538 and 548; tail, 67 and 89; hind foot, 131 and 134; ear from crown, 105 and 110. Type (adult female): head and body, 570; tail, 86; hind foot, 135; ear from crown, 101. Two adult females from Merton Hall, Norfolk: head and body, 575 and 583; tail, 80 and 90; hind foot, 141 and 135; ear from crown, 120 and 98. Adult female (grey pelage) from Pangbourne,

* See Barrett-Hamilton, The Irish Naturalist, March, 1898, pp. 69–76.

near Reading, Berkshire: tail, 75; hind foot, 135; ear from crown, 99. For cranial measurements see Table, p. 510.

Specimens examined.—Thirty-six, from the following localities:—
Scotland: Tulloch, Inverness, 1 (grey pelage); Raith, Fifeshire, 1; near Kilwinning, Ayrshire, 1 (grey pelage).
England: Isle of Man, 3; Bangor, Carnarvonshire, 2; Healey, Northumberland, 1; Swithland Hall, Leicestershire, 1; Merton Hall, Norfolk, 3; Barrow, Suffolk, 1 (U.S.N.M.); Sandringham, Norfolkshire, 2; Moorhampton, Hereford, 2; South Leigh, Oxfordshire, 1 (grey pelage); Hillingdon, Middlesex, 1; Pangbourne, near Reading, Berkshire, 1 (grey pelage); Marley Common, Haslemere, Surrey, 1; Weston Sands, Somerset, 2; Stokenham Kingsbridge, Devonshire, 1 (U.S.N.M.); Gasford Castle, Armagh, 2; south-east coast, Ireland, 1.
Ireland: Gasford Castle, Armagh, 2; south-east coast, 1.
Switzerland: Near St. Gallen, 4; Utzwil, St. Gallen, 1 (U.S.N.M.).

Remarks.—Though closely related to *Lepus europæus europæus*, this form is readily distinguishable by its darker, browner, general colour. The pale winter coat is rarely observed.

1.	Dingwall, Inverness-shire, Scotland.	Sydney Dennis (c & p).	3. 11. 14. 1.
♂.	Raith, Fifeshire.	W. R. Ogilvie-Grant (c & p).	93. 12. 23. 2.
♂.	Kilwinning, Ayrshire.	Hon. G. Montgomerie (c & p).	92. 2. 15. 1.
♂.	Isle of Man.	P. M. C. Kermode (c & p).	95. 1. 19. 1.
2.	Bangor, Carnarvonshire, Wales.	G. W. D. Assheton Smith (p).	97. 3. 8. 1. 3. 1. 28. 1.
1.	Healey, Northumberland, England.	Rev. H. H. Slater (c & p).	0. 2. 24. 1.
♂.	Swithland, Leicestershire.	Earl of Lanesborough (c & p).	92. 1. 29. 1.
♂, 2 ♀.	Thetford, Norfolkshire.	Lord Walsingham (p).	98. 2. 11. 1–3.
2 st.	Sandringham, Norfolkshire.	H.M. King Edward VII. (p).	96. 5. 9. 3–4.
♀.	Moorhampton, Herefordshire.	W. E. de Winton (c & p). (*Type* of subspecies.)	98. 2. 17. 1.
♂.	Moorhampton, Herefordshire.	W. E. de Winton (c & p).	3. 1. 26. 1.
♀.	South Leigh, Oxfordshire.	A. J. Butler (c & p).	93. 9. 7. 1.
♀.	Pangbourne, Berkshire.	Capt. Sawbridge (c & p).	0. 11. 16. 1.
♂.	Haslemere, Surrey.	S. J. Wigley (c & p).	6. 9. 18. 1.
2.	Weston Sands, Somersetshire.	Tomes Collection.	7. 1. 1. 175–176.
1.	England.	Purchased (Leadbeater).	88. b.
2.	Gasford Castle, Armagh, Ireland.	Hon. L. Powys (c & p).	76. 1. 25. 1–2.
♀.	South-east coast, Ireland.	Miss E. Hope.	6. 4. 12. 1.
♂, 2 ♀.	St. Gallen, Switzerland. (*E. H. Zollikofer.*)	O. Thomas (p).	2. 8. 4. 53–54. 4. 4. 5. 46–47.

Lepus europæus pyrenaicus Hilzheimer.

1906. *L[epus] e[uropæus] pyrenaicus* Hilzheimer, Zool. Anzeiger, xxx, p. 512, August 14, 1906.

1910. *Lepus europæus pyrenaicus* Trouessart, Faune Mamm. d'Europe, p. 220.

Type locality.—Bagnères [de Luchon?], Pyrenees, France.

Geographical distribution.—Pyrenean region, south-eastern France.

Diagnosis.—Essentially like *Lepus europæus europæus*, but smaller (hind foot, 113 to 125).

Specimens examined.—Five, from the Department of Ariège, France, and the neighbouring portion of Andorra.

Remarks.—The five specimens, though imperfect, do not appear to be referable to any of the other forms of *Lepus europæus*. They agree sufficiently well with *pyrenaicus* as described by Hilzheimer.

2 ♀, 1. Ax-les-Thermes, Ariège, France. V. Builles (C & P). 10. 9. 20. 1–3.

Lepus europæus meridiei Hilzheimer.

1859. ? *Lepus meridionalis* Gervais, Zool. et Paléont. Francaises, 2nd ed., p. 47 (Nomen nudum, based on the hare of Languedoc and Provence).

1906. *L[epus] e[uropæus] meridiei* Hilzheimer, Zool. Anzeiger, xxx, p. 512, August 14, 1904 (Aveyron, France).

1910. *Lepus europæus meridici* Trouessart, Faune Mamm. d'Europe, p. 220.

Type locality.—Department of Aveyron, France.

Geographical distribution.—South-central and south-eastern France, northern Italy, Corfu.

Diagnosis.—Size as in *Lepus europæus europæus;* colour browner and less buffy than in the typical form, and rump distinctly bluish grey, though less conspicuously contrasted with back than in the large *L. e. transsylvanicus.*

Measurements.—Four males from the neighbourhood of Nîmes, Gard, France, average and extremes: hind foot, 146·6 (140–152). Two males from Barcelonnette, Basses-Alpes, France: head and body, 528 and 540; tail, 112 and 95; hind foot, 138 and 140. Two males from Siena, Italy: head and body, 500 and 550; tail, 80 and 90; hind foot, 130 and 133; ear from crown, 116 and 118. Two females from the same locality: head and body, 550 and 558; tail, 88 and 92; hind foot, 130 and 134; ear from crown, 119 and 123. For cranial measurements see Table, p. 511.

Specimens examined.—Twenty, from the following localities:—

France: Near Nîmes, Gard, 7 (U.S.N.M. and Mottaz); near Digne, Basses-Alpes, 3 (Mottaz); St. Paul, near Barcelonnette, Basses-Alpes, 2.

ITALY: Ceresole d'Alba, Turin, 1 (Turin); Porlezza, Como, 1 (Ghidini); Siena, 4.
GREECE: Corfu, 2.

Remarks.—It is with some hesitation that I have referred the hares of northern Italy and of Corfu to this form. In the absence of more complete material it seems, however, the most satisfactory course to pursue.

2 ♂.	Barcelonnette, Basses-Alpes, France. (*C. Mottaz.*)	O. Thomas (P).	8. 8. 10. 133–134.
2 ♂.	Siena, Italy. (*S. Brogi.*)	Dr. E. Hamilton.	98. 10. 2. 18–19.
♂.	Corfu, Greece. (*C. Mottaz.*)	J. I. S. Whitaker (P).	8. 10. 1. 51.
♂.	Corfu.	C. Mottaz (C).	8. 11. 3. 23.

LEPUS EUROPÆUS CORSICANUS de Winton.

1898. *Lepus corsicanus* de Winton, Ann. and Mag. Nat. Hist., 7th ser., I. p. 155, February, 1898. Type in British Museum.
1906. *L[epus] m[editerraneus] corsicanus* Hilzheimer, Zool. Anzeiger, XXX, p. 513, August 14, 1906.
1910. *Lepus corsicanus* Trouessart, Faune Mamm. d'Europe, p. 224.

Type locality.—Bastia, Corsica.

Geographical distribution.—Corsica, Sicily and Italy (Rome).

Diagnosis.—Size small, as in *Lepus europæus pyrenaicus* (hind foot, 114 to 125 mm., occipitonasal length of skull about 90 to 94 mm.); general colour more yellow than in true *europæus*, the underfur conspicuously buff.

Colour.—The colour does not differ appreciably from that of *Lepus europæus europæus*, except that it is throughout somewhat brighter and more yellowish, and the colour pattern of the ear and the tawny markings below eye and at base of whiskers are better defined; nape patch scarcely indicated and without special colour. Underfur with three distinct colour bands; the basal grey and terminal blackish as in *L. europæus*, but with an intermediate band about 6 mm. in width of dull buff, thrown into strong contrast by the black. Inguinal patches light tawny. Rump dull ochraceous-buff, the bases of the hairs bluish grey (about grey No. 7 of Ridgway).

Skull and teeth.—Except for their reduced size the skull and teeth resemble those of *Lepus europæus europæus.*

Measurements.—Type (adult male): hind foot, 119; ear from crown, 105. Two males from Marsala, Sicily: hind foot, 114 and 120; ear from crown, 103 and 110 mm. Adult male from Rome, Italy: hind foot, 125; ear from crown, 127. For cranial measurements see Table, p. 511.

Specimens examined.—Four, from the following localities:—
CORSICA: Bastia, 1 (type).
SICILY: Marsala, 2.
ITALY: Rome, 1.

Remarks.—The conspicuously yellowish underfur of this hare is perhaps its most striking characteristic. With the material at hand I am unable to distinguish between the Corsican form and that of Sicily and Rome.

1.	Bastia, Corsica.	Lord Lilford (P).	78. 7. 3. 4. (*Type* of subspecies.)
2 ♂.	Marsala, Sicily.	J. I. S. Whitaker (P).	98. 2. 9. 1-2.
♂.	Rome, Italy. (*C. Coli.*)	G. Barrett-Hamilton (P).	8. 9. 30. 1.

Lepus europæus hybridus Desmarest.

1822. *Lepus hybridus* Desmarest, Mammalogie, p. 349 (Central Russia).

1842. *Lepus aquilonius* Blasius, Amtl. Bericht XIX Vers. Naturf. u. Aerzte, Braunschweig, p. 89 (Central Russia).

1850. *Lepus medius* Middendorff, Bull. de la Classe Phys.-Math. de l'Acad. Imp. des Sci. Nat. de Saint-Pétersbourg, IX, p. 218 (part).

1857. [*Lepus timidus*] c. Nordöstliche Form, Blasius, Säugethiere Deutschlands, p. 417 (part).

1898. *Lepus europæus* (typical) de Winton, Ann. and Mag. Nat. Hist., 7th ser., I, p. 150, February, 1898.

1906. *L[epus] m[edius] aquilonius* Hilzheimer, Zool. Anzeiger. XXX, p. 511, August 14, 1906.

1910. *Lepus medius aquilonius* Trouessart, Faune Mamm. d'Europe, p. 217.

Type locality.—Central Russia. Based on the Russak of Pallas (Nov. Sp. Quadr. Glir. Ord., p. 5).

Geographical distribution.—Central Russia, westward into eastern Germany.*

Diagnosis.—Size greater than in *Lepus europæus europæus* (hind foot about 15 mm.); colour in summer pelage essentially as in the typical form but lighter, the cheeks strongly suffused with dull white, the rump buffy grey with slightly darker median area; grey winter pelage habitually assumed.

Colour.—Though the actual elements of the colour of the body are essentially as in *Lepus europæus europæus*, the general effect is noticeably lighter, owing to the greater length of the subterminal cream-buff annulations. The rump is also more evidently grey in contrast with the back. White of interramial region spreading conspicuously so that cheeks are practically whitish throughout (except for a dull ochraceous-buff area under and behind eye and another at base of whiskers), in strong contrast with the grizzled buffy of crown, face and muzzle. Grey area on back of ear nearly white and forming a very conspicuous whitish rim to outer border. Inguinal patches clear, light ochraceous-buff. Collar somewhat duller and paler. Otherwise as in *L. europæus europæus*.

* While I have seen no German specimens of this hare there can be little doubt that it is the East Prussian animal referred to by Altum (Forstzoologie, 2nd ed., I, p. 181) as being not infrequently greyish white in winter. The same author gives rather extended observations on the occurrence of the grey winter coat in the hares of other parts of Germany.

Measurements.—Adult from Lithuania: hind foot, 155; ear from crown, 125.

Specimens examined.—One, from Lithuania.

Remarks.—This race appears to be well characterized by its large size, rather light colour of summer pelage, and the frequency with which the grey winter coat is assumed.

1. Lithuania. (*T. Barey.*) Branicki Museum (E). 94. 8. 7. 30.

Lepus europæus transsylvanicus Matschie.

1901. *Lepus transsylvanicus* Matschie, Sitz.-Ber. Gesellsch. Naturforsch. Freunde, Berlin, p. 236 (Taslau, Roumania).
1906, *L[epus] e[uropæus] transsylvaticus* Hilzheimer, Zool. Anzeiger xxx, p. 512, August 14, 1906.
1910. *Lepus europæus transsylvaticus* Trouessart, Faune Mamm. d'Europe, p. 221.

Type locality.—Taslau, Roumania.

Geographical distribution.—From Roumania southward through the Balkan Peninsula to the Peloponesus. Exact limits of range unknown.

Diagnosis.—Size nearly as great as in *Lepus europæus hybridus* (hind foot about 150 mm., occipitonasal length of skull in largest individuals 105 mm.); general colour dark and brownish, much as in *L. europæus meridiei*, the rump bluish grey in strong contrast with back; black area on posterior surface of ear normal in extent.

Measurements.—Adult male from Visoko, Bosnia, and from Herzegovina: hind foot, 150 and 148 mm.; ear from crown, 120 and 121 mm. For cranial measurements see Table, p. 511.

Specimens examined.—Eight, from the following localities:—
Bosnia: Visoko, 1.
Herzegovina: Mostar, 3; Dragajica, 1.
Albania: Coast opposite Corfu, 2.
Greece: Patras, 1.

Remarks.—While I have not seen Roumanian specimens of this hare, the Balkan skins agree so essentially with the original description that there seems little doubt that they represent the same form. Though readily distinguishable from *Lepus europæus europæus* its resemblance to *L. e. meridiei*, particularly to north Italian skins of this form, is rather close. The Balkan-Roumanian animal appears, however, to be sufficiently distinguished by its large size.

♂.	Visoko, Bosnia.	Dr. O. Reiser (C & P).	7. 10. 15. 3.
♂, ♀.	Surmancipolje, Herzegovina.	Dr. O. Reiser (C & P).	7. 10. 15. 1–2.
2 ♂.	Opposite Corfu, Albania. (*C. Mottaz.*)	J. I. S. Whitaker (P).	8. 10. 1. 49–50.

CRANIAL MEASUREMENTS OF *LEPUS EUROPÆUS*.

Locality.	Number.	Sex.	Occipitonasal length.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Postorbital constriction.	Breadth of brain-case.	Nasal (diagonal).	Greatest breadth, both nasals together.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.
L. europæus europæus.														
Denmark: Haslev, Zealand . .	8. 2. 15. 1	♂	95±	—	48·8	18·8	13·4	31·2	43·6	23·8	26·8	74·2	19·0	20·2
,, ,, . .	8. 2. 15. 2	♂	102·2	92·2	50·2	24·8	15·0	34·6	46·2	23·2	31·8	76·6	17·8	19·2
,, ,, . .	8. 2. 15. 4	♀	94·8	85·2	45·6	19·8	14·8	33·6	42·4	21·2	26·8	73·2	17·8	19·0
,, ,, . .	8. 2. 15. 5	♀	99·6	90·0	49·0	21·6	14·8	33·2	46·2	24·6	28·6	77·0	18·8	20·2
Germany: Brunswick . .	8. 9. 29. 3		—	-	46·6	24·4	15·2	-	44·2	24·2	28·0	72·4	18·6	19·2
,, . .	8. 9. 29. 1		99·6	86·6	49·0	22·0	13·8	34·0	45·2	22·6	28·0	74·6	17·8	19·4
,, . .	8. 9. 29. 2		98·8	88·6	49·6	21·2	13·6	35·2	42·2	22·6	28·6	75·8	19·2	21·0
Ingelheim, Rheinhessen			97·0	87·0	46·4	21·0	15·0	31·0	45·0	22·0	28·0	75·0	18·0	19·4
South Germany . .	59. 9. 6. 38		99·0	90·2	47·8	20·8	13·8	34·0	43·4	21·8	29·4	75·6	17·8	18·8
,, . .	59. 9. 6. 40		101·4	89·6	47·4	22·4	13·4	32·4	45·2	24·2	30·4	77·2	17·2	18·6
Austria-Hungary: Salzburg . .	82685		96·6	85·6	45·2	18·4	12·2	31·8	45·0	20·6	29·2	74·2	17·8	18·8
Switzerland: Rheinthal, St. Gallen	111553	♂	99·2	87·8	46·8	18·6	15·2	31·6	45·4	20·8	29·8	75·4	18·4	19·2
Wittembach, ,,	105830	♀	97·8	89·0	45·8	20·8	12·2	31·4	45·2	21·2	30·2	76·4	17·2	20·2
Werdenberg, ,,	105831	♀	101·6	89·4	47·8	20·0	11·4	34·0	45·0	23·4	28·2	75·4	18·6	20·0
L. europæus occidentalis.														
England: Isle of Man . . .	95. 1. 19. 1	♂	94·2	82·8	44·6	20·4	13·4	31·4	41·0	21·2	27·2	69·8	18·2	19·4
,, . . .	Grant, 18		93·0	81·0	44·6	21·4	14·0	32·0	41·0	21·4	26·4	72·0	17·4	19·0
,, . . .	,, 31		93·0	83·0	45·0	22·8	14·6	30·0	40·0	22·0	26·4	70·0	17·2	18·6
Merton Hall, Norfolk .	98. 2. 11. 1	♂	97·4	85·4	44·6	22·0	11·2	30·8	42·2	22·4	27·8	73·2	17·8	18·8

England: Merton Hall, Norfolk	98. 2. 11. 2	♀	96·6	86·6	45·4	22·2	13·4	31·6	44·4	22·4	28·0	74·0	18·8	18·8
,, ,,	98. 2. 11. 3	♀	98·2	86·4	47·4	20·4	14·4	31·4	42·4	21·2	27·4	75·0	19·0	20·0
Moorhampton, Hereford	98. 2. 17. 1*	♀	98·8	87·4	45·2	23·2	15·0	32·4	45·0	21·8	26·2	73·0	19·2	19·8
Hillingdon, Middlesex	90. 3. 1. 1		98·4	85·4	45·4	21·4	14·4	32·4	44·4	20·4	28·8	74·4	18·4	20·2
Vaynol Park, near Bangor	97. 3. 8. 1		100·4	88·8	48·2	22·0	13·6	34·8	44·2	20·0	30·0	77·6	18·4	19·2
Tulloch Castle	3. 11. 14. 1		97·6	87·0	46·8	23·4	15·2	33·2	44·0	22·4	28·6	75·2	18·8	20·8
Switzerland: Utzwil, St. Gallen	105828	♀	100·0	90·2	48·2	20·2	15·8	33·0	43·6	22·4	29·2	77·8	18·2	18·8
L. europæus meridiei.														
France: Nimes, Gard	Hu. 347 Mottaz	♂	103·0	90·0	45·0	22·0	13·6	33·0	48·6	23·4	29·0	76·6	17·2	18·0
,, ,,	Hu. 361 Mottaz		96·0	87·0	45·0	20·0	13·0	33·0	43·0	21·0	28·0	74·0	17·4	18·6
Barcelonnette, Basses-Alpes	8. 8. 10. 133		92·2	83·4	45·2	20·8	14·2	32·6	41·0	19·4	27·8	73·0	16·8	18·0
,, ,,	8. 8. 10. 134		101·6	89·8	43·2	20·4	14·2	33·6	45·2	21·2	30·2	75·0	17·8	18·8
Italy: Ceresole d'Alba, Turin	Turin	♀	101·0	87·0	46·0	21·0	15·8	32·4	46·0	23·8	28·6	76·0	18·0	18 2
Siena	153400	♀	100·0	90·0	46·8	20·4	13·0	31·8	47·0	25·0	32·0	77·4	18·0	19·0
,,	98. 10. 2. 18	♂	95·6	85·0	44·6	20·6	14·6	30·8	45·0	21·8	28·0	70·0	16·0	17·0
L. europæus corsicanus.														
Italy: Rome	8. 9. 30. 1		93·2	81·8	45·6	18·6	13·2	30·6	39·6	21·4	26·2	69·8	17·2	17·8
Sicily: Marsala	98. 2. 9. 1	♂	89·6	76·6	44·8	20·4	12·8	31·6	40·4	21·4	25·0	70·0	17·6	19·0
Corsica: Bastia	78. 7. 3. 4*	♂	89·6	—	43·6	18·4	14·8	31·8	38·4	20·8	25·4	65·4	16·8	17·8
L. europæus transsylvanicus.														
Bosnia	7. 10. 15. 3	♂	97·6	86·4	47·0	20·2	15·2	33·4	45·4	22·8	28·0	76·0	18·4	19·6
Mostar	153402	♂	101·4	92·2	46·4	20·8	14·0	33·4	45·6	22·2	31·2	76.4	17·0	18·4
Visoko	153401	♂	105·0	—	48·6	20·8	13·8	34·2	46·2	23·8	32·8	81·8	18·2	19·0
Albania: coast opposite Corfu	8. 10. 1. 49	♂	99·4	88·0	—	20·2	—	—	46·0	22·6	29·8	74·2	17·8	19·0

* Type.

LEPUS CRETICUS Barrett-Hamilton.

1903. *Lepus creticus* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., XI, p. 126, January, 1903. Type in British Museum.

1905. *Lepus europæus creticus* Bate, Proc. Zool. Soc., London, 1905, II, p. 322, April 5, 1906.

1910. *Lepus creticus* Trouessart, Faune Mamm. d'Europe, p. 222.

Type locality.—Crete and Cephalonia.

Geographical distribution.—Crete.

Diagnosis.—General colouration light brownish essentially as in *Lepus europæus transsylranicus* and *L. parnassius*, but paler, the rump conspicuously grey; size rather small, about equal to that of *L. europæus corsicanus* (hind foot, 117–127 mm.; occipito-nasal length of largest skulls about 95 mm.); cheeks grey, noticeably grizzled; ear scantily haired, very slightly buff-tinged.

Colour.—Upper parts a mixture of blackish and a very pale, dull cream-buff, the general effect a coarsely grizzled brown, becoming conspicuously grey on rump, but scarcely paler on sides of body than on back. Underfur silvery grey at base. Rump crossed by evident dark median area continuous with black of tail. Nape patch wood-brown tinged with russet in rather noticeable contrast with surrounding parts. Collar varying from wood-brown to dull ochraceous-buff, usually grizzled with buffy white, the former predominating. Head a fine grizzle of same elements as body colour, the pale markings before and behind eye silvery whitish though not very extensive. Cheeks essentially like crown, distinctly grizzled and with an evident greyish cast, the rusty markings obsolete. Muzzle and lips dull cream-buff. Anterior outer surface of ear sepia finely and inconspicuously grizzled with cream-buff and fringed along border with bluish or buffy white; posterior outer surface a light bluish grey (about grey No. 10 of Ridgway) throughout, except for the usual blackish (seal-brown) terminal area; inner surface sparsely sprinkled with fine bluish grey hairs except on the brownish area along posterior margin; a faintly indicated buffy sub-terminal area; posterior margin whitish except near tip. Feet a dull buffy brown. Underparts (except collar) and inner surface of legs white, slightly tinged with pale buff. Inguinal patches dull ochraceous-buff.

Skull and teeth.—The skull is of medium size, the occipito-nasal length in old individuals about 96 mm. In form it is scarcely distinguishable from that of *L. europæus*. Anterior portion of zygoma essentially as in *L. europæus*, but showing a decided tendency to become deeper. The teeth show no peculiarities.

Measurements.—Average and extremes of three specimens from Crete: hind foot, 124·3 (123–126); ear from crown, 116 (115–117). Average and extremes of six adults from Cephalonia:

head and body, 490 (483–495); tail, 92 (80–100); hind foot, 122·5 (117–127). For cranial measurements see Table, p. 520.

Specimens examined.—Twelve, from the following localities:—
CRETE, 5.
CEPHALONIA, 7.

Remarks.—While resembling the brown races of *Lepus europæus* the Cretan hare is readily distinguishable by its smaller size and relatively somewhat larger ears.

2.	Crete.	H. O. Jones, R.N. (c).	99. 2. 14. 1–2.
1.	Crete.	H. O. Jones, R.N. (p). (*Type* of species.)	2. 11. 9. 1.
♂.	Kanea, Crete.	Miss D. Bate (c).	5. 12. 2. 34.
♂, 4 ♀.	Mt. Vuno, Cephalonia, Greece. (*C. Mottaz.*)	J. I. S. Whitaker (p).	8. 10. 1. 52–56.
♂, ♀.	Mt. Vuno, Cephalonia.	C. Mottaz (c).	8. 11. 3. 20–21.

LEPUS MEDITERRANEUS Wagner.

1841. *Lepus mediterraneus* Wagner, Münch. Gelehrt. Anzeiger, p. 439, March 17, 1841.

1857. [*Lepus timidus*] a. Südeuropäische Form, Blasius, Säugethiere Deutschlands, p. 417 (part).

1898. *Lepus mediterraneus* de Winton, Ann. and Mag. Nat. Hist., 7th ser., I, p. 154, February, 1898.

1906. *L*[*epus*] *m*[*editerraneus*] *typicus* Hilzheimer, Zool. Anzeiger, XXX, p. 512, August, 1906.

1910. *Lepus mediterraneus* Trouessart, Fanne Mamm. d'Europe, p. 224.

Type locality.—Sardinia.
Geographical distribution.—Sardinia.

Diagnosis.—Smallest of the European hares (hind foot, 93 to 103; occipitonasal length of skull, 81·4 to 87 mm.); colour much as in *Lepus granatensis*, but white of underparts encroached on by ochraceous-buff of sides, and not extending on legs, the inner and outer surfaces of which are not evidently contrasted.

Colour.—Back essentially as in *Lepus granatensis granatensis*, but elements more intimately blended, and ground colour a more yellowish cream-buff, this slightly in excess of black. Underfur with dull buff sub-terminal area (5 mm.) and black tips (4 mm.) well defined, the bases of the hairs bluish grey (about the pearl-grey of Ridgway). Sides with wide and noticeable clear buffy area (the exact shade darker and more yellow than the ochraceous-buff of Ridgway), strongly incroaching on white of underparts, and continuous with inguinal patches and inner surface of legs, on fore legs becoming slightly paler, and on hind legs more yellow. On outer surface of legs and dorsal surface of feet this colour darkens so as to form a conspicuous contrast with cream-buff of back, though there is no evident line of demarcation between the two surfaces of the legs. Rump slightly more buffy than back.

Tail with the usual black and white areas. Nape patch rather well defined, concolor with outer surface of legs. Head essentially like back but more finely grizzled; cheeks like crown or somewhat suffused with ochraceous-buff, the pale eye-ring and the spot before and behind eye obsolete; a clear dark ochraceous-buff patch at base of whiskers; muzzle dull buffy or greyish, forming no distinct contrast with surrounding parts. Ear dark and dull, the colour pattern ill-defined, and the narrow whitish rim of outer border thrown into unusually strong contrast; anterior outer surface and dark area on inner surface prout-brown slightly grizzled with dull buffy; grey of posterior outer surface extending nearly to base of ear; black area normal; no grey on inner surface, this region, except on dark area, everywhere ochraceous-buff like fringe of inner border. Collar dull ochraceous-buff irregularly washed and varied with cream-buff. Interramial region very dull white or pale ochraceous-buff. White of underparts limited to a narrow area, not more than 50 mm. across, extending from posterior portion of chest to inguinal patches, which may or may not completely separate it from the white of intercrural region and base of tail. Anterior portion of chest whitish ochraceous-buff like inner surface of fore legs.

Skull and teeth.—The skull of *Lepus mediterraneus* is immediately distinguishable among European hares by its extremely small size, the occipitonasal length in a fully adult male being only 83·6 mm., thus scarcely exceeding that of *Oryctolagus cuniculus*. In form and in the proportions of the different parts it shows, however, no marked peculiarities, agreeing, in most respects, with the large *Lepus europæus*, though the auditory bullæ more nearly approach the form occurring in *L. granatensis*. Anterior portion of zygoma remarkably variable in form. Among the four skulls examined two have this region essentially as in *L. europæus*, one more nearly approaches the *timidus* type, while in the fourth, although fully adult, the groove is so shallow and ill-defined as to be practically absent, a condition that I have not seen in other European hares. Teeth peculiar in their small size only.

Measurements.—Adult male and female: hind foot, 103 and 96; ear from crown, 114 and 109. Two other specimens, sex not noted: hind foot, 93 and 95; ear from crown, 97 and 99. For cranial measurements see Table, p. 520.

Specimens examined.—Six, all from Sardinia.

Remarks.—This very distinct species is at once recognizable among European hares by its small size and dull colour.

2.	Sassari, Sardinia.	Genoa Museum (E).	97. 2. 27. 1–2.
♂, ♀.	Cagliari, Sardinia. (*Mazza.*)	Genoa Museum (E).	98. 5. 12. 1–2.

LEPUS GRANATENSIS Rosenhauer.

(Synonymy under subspecies.)

Geographical distribution.—Iberian Peninsula and Balearic Islands. Exact northern limits of range not known.

Diagnosis.—Size rather small, about as in *Lepus corsicanus*, and *L. creticus* (hind foot, 115–120; occipitonasal length of skull about 80–90 mm.); colour differing from that of all the other European hares, except the much smaller *L. mediterraneus*, in the bright, reddish colour of the outer surface of the thighs, which forms the marked contrast with buffy of back; inner surface of legs normally white, the line of demarcation very sharply defined; dorsal surface of feet and wrists marked with pure white; lengthened whitish hairs on sides very conspicuous. Mammæ as in *L. europæus*.

Colour.—Upper parts buffy underlaid on back with blackish, the two colours forming a coarse mixture, varying considerably according to condition of pelage, but the buffy always in excess. On sides the black gradually disappears, leaving a narrow, nearly clear buffy line bordering white of underparts. Rump usually concolor with back, but sometimes tinged with grey. Sides with a very conspicuous sprinkling of hairs about 50 mm. in length, their basal portion blackish, the terminal half white. Tail as in *Lepus europæus*. Nape patch usually small and ill-defined. Head essentially like body but with the darker and lighter colours finely blended. Cheeks and crown alike; eye-ring about as in *L. europæus*, but pale area before and behind eye barely indicated, and no distinct rusty suffusion below eye; muzzle clear dull buffy; a darker area at base of whiskers. Ear as in *Lepus europæus*, but colour pattern more strongly defined and black terminal area usually, though not always, more extensive; outer border conspicuously rimmed with whitish. Outer surface of thigh conspicuously brighter than body, its colour approaching cinnamon-rufous and very sharply contrasted with the pure white of inner surface of leg. Outer surface of fore leg not so bright as that of thigh but forming a strong contrast with sides of body. Inguinal patch dull ochraceous-rufous. Collar a dark, scarcely grizzled buffy. Rest of underparts a peculiarly snowy white, the white area unusually wide and well defined, extending down hind leg and covering dorsal surface of foot to base of claws, and usually though not always extending similarly on front leg to wrist where a white spot is invariably present. Soles an indefinite buffy brown.

Skull and teeth.—The skull of *Lepus granatensis* is rather small, the occipitonasal length seldom exceeding 90 mm. In form it differs from that of the other European hares in the less deflection of the brain-case, and consequently less strong convexity of the dorsal profile, a character not easily defined but readily

appreciable on inspection, and evidently of much importance in a group showing such remarkable uniformity in cranial characters. The auditory bullæ are relatively larger than in the other species, so that, when skull is viewed from below, the area of each bulla appears to be about equal to that of flat portion of basioccipital in front of condyles. Anterior portion of zygoma strictly as in *L. europæus*. Teeth rather small but not showing any special peculiarities of structure.

Remarks.—The Iberian hare is at once distinguishable from the other European members of the genus by the unusually bright colour of the outer surface of the thighs and the presence of white markings on the feet. The form of the skull is also characteristic. Three local races are at present known.

Lepus granatensis granatensis Rosenhauer.

1856. *Lepus granatensis* Rosenhauer, Die Thiere Andalusiens, p. 3 (Granada).

1867. [*Lepus*] *hispanicus* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien. Math.-Naturwiss. Classe, LVI, p. 161 (Substitute for *granatensis*. "Natt." cited as authority).

1897. *Lepus meridionalis* Graells, Mem. Real Acad. Sci., Madrid, XVII, p. 525 (Vicinity of Madrid).

1898. *Lepus lilfordi* de Winton, Ann. and Mag. Nat. Hist., 7th ser., I, p. 153, February, 1898 (Seville). Type in British Museum.

1906. *L[epus] e[uropæus] granatensis* Hilzheimer, Zool. Anzeiger, XXX, p. 512, August 14, 1906.

1907. *Lepus granatensis granatensis* Miller, Ann. and Mag. Nat. Hist., 7th ser., XX, pp. 399, November, 1907.

1910. *Lepus granatensis* Trouessart, Faune Mamm. d'Europe, p. 222.

Type locality.—Granada, Spain.

Geographical distribution.—The greater portion of Spain, extending at least from the Province of Burgos to the south and east coasts; Balearic Islands.

Diagnosis.—Ear long, its height from crown in dried specimens 105–115 mm.; general aspect pallid, the ground colour of back nearly the cream-colour of Ridgway and much in excess of black.

Colour.—Underfur (17 mm.) bluish grey at base, the hairs becoming buffy terminally, the extreme tips slightly darker but not definitely black; longer hairs (30 mm.) greyish at base, then black to tip, each with a conspicuous, sharply defined sub-terminal annulation (4 mm.) of pale cream-buff. Clear area along sides (ill-defined) between cinnamon-rufous and ochraceous-rufous, becoming somewhat more dull on inguinal patches and darker and brighter on outer surface of thighs. Outer side of front leg a duller shade of the same colour; inner surface white to wrist, where the white crosses to upper surface and forms a conspicuous patch on metacarpals. Collar pale wood-brown strongly washed with pale dull ochraceous-buff. Chin somewhat dusky.

Skull and teeth.—In the typical form the skull is of maximum size for the species, occipitonasal length of full-grown individuals ranging from 86·4 to 90·4 mm.

Measurements.—Adult from Granada: hind foot, 115; ear from crown, 120. Two males from Seville (the second the type of *lilfordi*): hind foot, 114 and 116; ear from crown, 118 and 120. Two females from the same locality: hind foot, 111 and 114; ear from crown, 110 and 113. Adult male and female from Silos, Burgos: head and body, 500 and 520; tail, 95 and 87; hind foot, 117 and 118; ear from crown, 110 and 112. For cranial measurements see Table, p. 521.

Specimens examined.—Fifteen, from the following localities in Spain: Silos, Burgos, 2; Castrillo de la Reina, Burgos, 2; Seville, 4; Las Marismas, near Seville, 1; Granada, 1; Jerez, Cadiz, 1; Coto Doñana, Huelva, 2; no exact locality, 1; Selva, Majorca, Balearic Islands, 1.

2 ♀.	Castrillo, Burgos, Spain.	G. S. Miller (C).	8. 8. 4. 120–121.
2.	Coto Doñana, Huelva.	A. Chapman (C & P).	8. 3. 8. 8–9.
2 ♂, 2 ♀.	Seville. (*Dr. A. Ruiz.*)	Lord Lilford (P).	95. 3. 3. 11–14. (95. 3. 3. 12. *Type* of *L. lilfordi* de W.)
1.	Las Marismas, near Seville.	H. F. Witherby (C & P).	0. 2. 17. 1.
1.	Granada.	Col. J. H. Irby (C & P).	96. 7. 29. 1.
juv.	Jerez, Cadiz.	A. Chapman (C & P).	8. 3. 8. 16.
1.	Spain.	Lord Lilford (P).	75. 2. 11. 3.
1.	Selva, Majorca, Balearic Islands. (*M. Riutort.*)	O. Thomas (P).	1. 3. 6. 2.

LEPUS GRANATENSIS GALLÆCIUS Miller.

1907. *Lepus granatensis gallæcius* Miller, Ann. and Mag. Nat. Hist., 7th ser., xx, p. 400, November, 1907. Type in British Museum.

1910. *Lepus granatensis gallaecius* Trouessart, Faune Mamm. d'Europe, p. 223.

Type locality.—La Coruña, Province of Coruña, Spain.

Geographical distribution.—At present known from extreme north-west Spain only.

Diagnosis.—Similar to *Lepus granatensis granatensis*, but colour throughout dark and rich, the ground colour of back nearly the ochraceous-buff of Ridgway, and scarcely in excess of black; white markings on front leg not so extensive as in the typical form.

Colour.—Underfur with buff distinctly brighter than in *Lepus granatensis granatensis*, and extreme tips of the hairs becoming definitely black. Sub-terminal annulations of longer hairs light ochraceous-buff. Clear area along sides dull cinnamon-rufous, the inguinal patches similar, but outer surface of thigh and of front leg distinctly darker and brighter. Inner surface of front leg with white extending to wrist or not beyond elbow, the usual white markings at wrist present in either case, though

slightly less extensive than in *L. granatensis granatensis*. Collar a dark wood-brown washed with yellowish clay-colour. Head and ears noticeably darker than in the typical form, and eye-ring thrown into rather strong relief. A conspicuous dull cinnamon-rufous patch at base of whiskers. Chin conspicuously dusky in strong contrast with surrounding parts.

Measurements.—Type: hind foot, 107; ear from crown, 105. Adult from Vigo: hind foot, 110; ear from crown, 105. For cranial measurements see Table, p. 521.

Specimens examined.—Two, one from La Coruña, the other from Vigo.

1.	Vigo, Pontevedra, Spain.	Lord Lilford (P).	82. 12. 8. 1.
♂.	La Coruña, Coruña, Spain.	Dr. F. L. Seoane (C & P). (*Type* of subspecies.)	94. 2. 16. 1.

Lepus granatensis iturissius Miller.

1907. *Lepus granatensis iturissius* Miller, Ann. and Mag. Nat. Hist., 7th ser., xx, p. 401, November, 1907. Type in British Museum.
1910. *Lepus granatensis iturissius* Trouessart, Faune Mamm. d'Europe, p. 223.

Type locality.—Basses-Pyrénées, near Biarritz, France. The type was probably bought in the Biarritz market, but a note published by the collector in the Field, lxxxix, January 30, 1897, p. 135, refers to the animal as occurring on the Spanish side of the border.

Geographical distribution.—Known only from the type locality.

Diagnosis.—Colour essentially as in *Lepus granatensis granatensis*; ear short (only 95 mm. instead of 105–115 mm.); skull small and slender, its occipitonasal length 82 mm. instead of 85–90 mm.

Colour.—The colour so exactly resembles that of *Lepus granatensis granatensis* as to require no special description.

Skull and teeth.—The skull differs from that of *Lepus granatensis granatensis* in its distinctly smaller size (occipitonasal length only 82·4 mm.), in the even less convex dorsal profile, and the relatively more slender rostrum. The rostral depth at front of tooth-row in the type specimen is 17 mm., while in *L. granatensis granatensis* it ranges from 19 to 21 mm. Teeth as in the typical form.

Measurements.—Type: hind foot, 110; ear from crown, 95. For cranial measurements see Table, p. 521.

Specimen examined.—The type.

Biarritz, Basses-Pyrénées, France. (*Greig.*)	J. E. Harting (P). (*Type* of subspecies.)	97. 6. 15. 1.

LEPUS PARNASSIUS Miller.

1903. *Lepus parnassius* Miller, Proc. Biol. Soc. Washington, XVI, p. 145, November 12, 1903. Type in U.S. National Museum.

1908. *Lepus e[uropæus] parnassius* Hilzheimer, Jahreshefte des Vereins für vaterl. Naturk. in Württemberg, p. 395.

1910. *Lepus europæus parnassius* Trouessart, Faune Mamm. d'Europe, p. 221.

Type locality.—Agoriani (Agokgiannē), north side of Lyakuia (Parnassus) Mountains, Greece.

Geographical distribution.—Known only from the type locality.

Diagnosis.—General appearance much as in *Lepus creticus*, but size larger (hind foot about 135 mm., occipitonasal length of skull about 95 mm.), and ear much longer (height from crown about 130 mm. instead of 105 to 117 mm.), the black area on its outer side noticeably more extensive; skull with rostral portion unusually long and slender; no trace of m^3 in the two specimens known; m_3 with the two enamel cylinders broadly communicating.

Colour.—General colour of upper parts a coarse grizzle of black and pinkish buff, the latter slightly in excess, much less so than the cream-buff of the corresponding region in *Lepus europæus*. Actual colour bands as follows: (1) whitish smoke-grey, 12 mm., (2) black, 7 mm., (3) pinkish buff, 5 mm., (4) black, 5 mm., the first and second on the underfur, the others on the longer hairs. Sides and neck not noticeably different from back, but the grizzle less distinct owing to the replacement of the black of underfur by hair-brown. Rump essentially like back, but with a slight, inconspicuous greyish cast due to the light grey bases of the hairs. The exact shade of this undercolour is about Ridgway's grey No. 10 at base of hairs, darkening to grey No. 7 near surface. Cheeks like sides but more finely grizzled, and with a faint blackish wash below ear. An indistinct greyish-buff eye-ring and loral stripe. Crown and face like back but more finely grizzled, and bases of hairs wood-brown. Nape patch ill-defined, an obscure russet wood-brown overlaid by the usual buff. Ears light silvery grey (the exact colour not given by Ridgway), except for the following markings: a very finely grizzled stripe essentially concolor with top of head extending up anterior outer surface almost to tip, and about 20 mm. wide at middle; a similar area 45 mm. long by 12 mm wide near middle of posterior inner surface; a black apical patch 40 mm. long by 30 mm. wide on posterior outer surface; a black apical area on inner surface about 10 mm. wide; a clear ochraceous-buff area 10 mm. in width between apical black and general grey of inner surface; a whitish line 3 mm. in width along inner anterior margin from base to above middle. Feet, outer surface of legs, flank patches, and throat, dull ochraceous-buff. Under-

CRANIAL MEASUREMENTS OF *LEPUS CRETICUS*, *L. MEDITERRANEUS*, *L. GRANATENSIS* AND *L. PARNASSIUS*.

Locality.	Number.	Sex.	Occipitonasal length.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Postorbital constriction.	Breadth of brain-case.	Nasal (diagonal).	Greatest breadth of both nasals together.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.
L. creticus.														
Crete	2. 11. 9. 1*		95·6	84·0	45·4	22·4	15·0	32·0	44·4	23·2	28·2	75·0	17·2	17·8
,,	2. 11. 9. 2		96·4	85·4	44·4	19·2	12·8	30·4	44·2	21·0	29·2	74·0	17·2	18·0
,,	99. 2. 14. 2		94·4	84·0	44·8	19·8	12·8	31·6	43·4	20·4	27·6	70·6	17·0	17·8
Cephalonia	8. 10. 1. 52	♂	—	-	44±	21·6	15·0	—	40·8	19·8	27·2	—	17·2	18·4
,,	8. 10. 1. 55	♀	90·4	80·4	42·2	17·8	13·8	30·8	40·2	18·8	26·6	70·0	16·2	17·0
,,	8. 10. 1. 53	♀	93·2	83·2	43·4	20·2	13·6	31·2	40·6	21·2	27·8	70·0	16·2	16·8
,,	8. 10. 1. 54	♀	92·4	82·8	42·8	19·8	13·2	30·4	39·4	19·0	27·6	70·8	16·8	17·6
L. mediterraneus.														
Sardinia: Cagliari	98. 5. 12. 1	♂	83·6	73·0	—	17·8	11·4	—	36·4	19·0	22·0	—	16·0	16·4
,,	98. 5. 12. 2	♀	82·4	73·4	41·0	19·0	12·0	30·0	35·0	20·0	21·8	63·2	15·6	16·6

Sardinia: Sassari . . .	Genoa	♀	81·4	73·0	40·6	21·0	11·8	30·0	36·0	20·4	24·0	62·8	14·6	14·8
near Mt. Narba .	,,		87·0	77·2	41·8	23·4	10·0	30·0	39·6	22·2	26·0	65·0	14·0	15·0
L. granatensis granatensis.														
Spain: Silos, Burgos . .	172246	♂	88·0	78·0	42·0	18·8	13·4	29·6	39·0	18·8	25·0	66·0	16·0	16·8
,, ,, . .	172245	♀	86·4	78·0	41·0	18·0	13·6	29·8	39·6	18·8	25·6	65·6	15·0	15·8
Seville . . .	95. 3. 3. 12†	♂	88·6	77·6	42·8	19·0	12·4	31·8	37·4	20·0	24·4	67·0	16·2	17·6
Las Marismas . .	0. 2. 17. 1		90·4	80·2	43·0	18·0	12·0	31·0	40·8	19·0	25·4	69·0	16·4	17·2
L. granatensis gallæcius.														
Spain: La Coruña, Coruña .	94. 2. 16. 1*		88·0	77·0	41·4	18·4	13·8	30·0	39·0	17·8	26·4	66·0	15·0	16·8
L. granatensis iturissius.														
France: Basses-Pyrénées .	97. 6. 15. 1*		82·4	72·6	39·4	16·0	13·0	29·8	36·4	18·8	22·6	61·0	14·8	15·8
L. parnassius.														
Greece: Agoriani, Parnassus Mts.	122093*	♂	95±	—	44·2	19·8	14·2	30·4	43·8	20·6	30·2	74·2	15·2	17·8

* Type.

† Type of *lilfordi* de Winton.

parts and inner surface of legs white, much suffused with ochraceous-buff on front legs. Collar very wide, essentially like sides of body, but without black and with a decided tinge of wood-brown.

Skull.—The skull differs from that of *Lepus europæus* in smaller size and much less robust form. This is particularly noticeable in the rostral region, which is relatively elongated and narrowed, though not much reduced in depth. In the type the distance from front of zygoma to gnathion is 41·4 mm., while in a Swiss skull of *L. europæus* with the same occipitonasal length it is only 38·6 mm. The width and depth of rostrum at level of point of junction between lower border of nasal and upper border of premaxillary are respectively 16·0 mm. and 19·2 mm. in the type and 18·2 mm. and 20 mm. in the Swiss specimen. In other respects the skull shows no tangible characters to distinguish it from that of *L. europæus.**

Teeth.—The teeth differ from those of all other European hares in the absence, in the type, and a very young specimen (in *L. europæus* of same age it is plainly visible) of m^3, and in the broad communication of the two cylinders of m_3 along their region of contact, this peculiarity combined with a general reduction in the relative size of the tooth. In other respects the teeth show no tangible characters to distinguish them from those of *L. europæus*, though the posterior wall of the re-entrant angle in the second, third and fourth upper cheek-teeth is thrown more conspicuously into minute folds, like those of anterior wall, than is usual in European hares.

Measurements.—Type (adult but not old male): head and body, 570±; hind foot, 135 mm.; ear from crown, 130 mm. For cranial measurements see Table, p. 521.

Specimens examined.—Two, the type and a very young individual with crowns of cheek-teeth not worn away, both from Agoriani (U.S.N.M.).

LEPUS TIMIDUS Linnæus.

(Synonymy under subspecies.)

Geographical distribution.—Northern portion of Europe and Asia; exact limits of range unknown. In Europe throughout Norway, Sweden and northern Russia, also in Scotland and the Alps.† Represented in Ireland by a distinct though nearly related species.

Diagnosis.—Tail short, its length including terminal hairs much less than that of hind foot, its upper surface white or grizzled, never with black median area; ear only moderately long, extending when laid forward about to nostril or slightly

* In the type the basicranial region and auditory bullæ are missing.

† Often referred to as occurring in the Pyrenees, but this undoubtedly erroneous (see Trutat, Bull. Soc. Hist. Nat. Toulouse, XII, p. 110, 1878).

beyond ; general colour of upper parts a finely grizzled greyish brown (approaching the broccoli-brown and hair-brown of Ridgway) in summer, white or pale grey in winter, the extreme tip of ear always black ; root of upper incisor long, extending to suture between premaxillary and maxillary ; height of posterior upper premolar measured from crown to upper surface of root capsule greater than alveolar length of tooth-row.

External characters.—Externally much as in *Lepus europæus* except for the shorter tail and ear, and more woolly fur. Mammæ : p 1–1, a 3–3 = 8.

Colour.—Summer pelage : general colour of upper parts between hair-brown and sepia, inconspicuously grizzled with cream-buff, the sides not so dark as back, the rump sooty blackish ; cheeks, muzzle and outer surface of legs tinged with buffy ; nape and back of neck to shoulders not grizzled, the general colour of this area between wood-brown and broccoli-brown. The colours on back are arranged as follows : underfur (10 mm.) light pearl-grey at base changing to light wood-brown at middle ; longer hairs (25 to 30 mm.) greyish at base, then dark sepia, each with a cream-buff sub-terminal annulation about 2 mm. long and a blackish slightly longer tip ; a few still longer hairs (35 mm.) entirely blackish except the grey base ; still others in some specimens pure white. On sides and rump the grey portion of underfur extends nearly or quite to tips of hairs. Tail bluish white, the median region of upper surface an indefinite grizzled brown. Ear blackish or brownish, the inner surface sprinkled to a varying extent with whitish or buffy hairs, the outer margin always buffy whitish, the tip always clear black, this area either confined to rim or extending down outer surface for a distance of from 5 to 20 mm. Inner surface of legs and entire underparts (except collar) white or whitish usually with a slight buffy tinge and frequently darkened by a sprinkling of blackish hairs. Chin and interramia white or greyish, always contrasted with the grizzled brownish collar, the latter essentially like back or somewhat paler. Feet dull buffy brown varied with white or cream-buff. General hue of upper parts sometimes more yellowish, owing chiefly to the wood-brown of underfur brightening toward ochraceous-buff. Winter pelage white or grey. In the former, more usual phase the animal is white throughout, except the palms and soles, which are wood-brown, and the tip of ear, which retains the narrow black area as in summer. Underfur everywhere white, occasionally with a faint greyish tinge at base, or a slight buffy cast at tips of hairs. Rarely there is a slight greyish wash along anterior border of outer surface of ear. Grey phase : upper parts and sides light grey, clear and somewhat drabby on sides of body, neck and cheeks, noticeably tinged with wood-brown on face, crown, ears and back, the latter region further darkened by a faint clouding of black ; region immediately surrounding eye nearly white, this area forming a well

defined band about 5 mm. wide over upper lid; ear with same colour pattern as in summer; underfur of back and sides bluish grey (about grey No. 8 of Ridgway) at base (10 mm.), the tips of the hairs (5 mm.) wood-brown on back, light buffy or buffy grey on sides; longer hairs of sides whitish, those of back dark brown or blackish, each with a conspicuous annulation (about 4 mm. wide) of whitish cream-buff, the extreme tip black; outer surface of legs irregularly washed with light buffy wood-brown; underparts white, a little tinged with buffy on throat, where an ill-defined collar is produced by the buffy wood-brown of underfur; tail white, tinged with bluish grey above, the black tip of ear remaining in all cases as in summer.

Skull.—In general form the skull resembles that of *Oryctolagus cuniculus*. The size is, however, decidedly greater than in either of the European wild rabbits (occipitonasal length about 90 to 100 mm. instead of about 70 to 83 mm.) and the proportions are more robust. There are also numerous differences in details of structure. Most important of these are the peculiarities of the postorbital processes, interparietal, and mesopterygoid region already alluded to as generic characters. Brain-case relatively shorter and wider than in *Oryctolagus*, its greatest width about equal to distance from lambdoid suture at side of interparietal to posterior base of postorbital process; parietal region distinctly flattened, the lateral convexity much less than in *Oryctolagus* and *Lepus europæus*. Anterior half of frontal noticeably concave, the orbital rims rising gradually but considerably above general level of interorbital region. Malar less projecting posteriorly than in *Oryctolagus*, its tip extending less than half way from posterior border of glenoid surface to auditory meatus. Length of exposed portion of suture between malar and zygomatic process of squamosal about equal to height of zygomatic process (in *Oryctolagus* it is much greater than height of process). Upper border of malar thickened anteriorly, everted and obliquely plate-like posteriorly; elevated region in front of lateral groove deep and narrow, the least distance from groove to front of zygoma less than depth through same region. Rostrum heavy and rather short, its depth to anterior rim of alveolus of first cheek-tooth about equal to distance from latter point to front of incisive foramen. Auditory bulla essentially as in *Oryctolagus*, the anterior border more abruptly rounded off than in *Lepus europæus*.

Teeth.—The teeth do not differ materially from those of *Lepus europæus*. Incisors both above and below more squarish in cross section; groove on anterior face of i^1 in same position as in the more southern animal; root extending to suture between premaxillary and maxillary, the entire course of the tooth clearly indicated on outer surface of bone. Anterior upper premolar usually less narrowly elliptical in cross section than that of *L. europæus*, its inner re-entrant angle appearing to

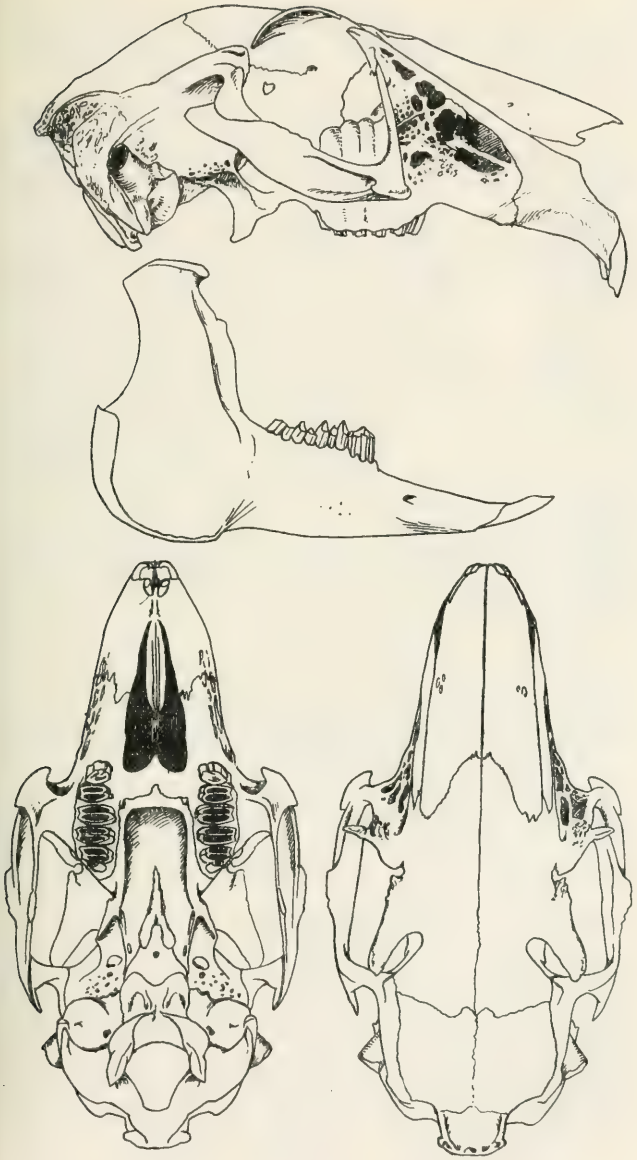

FIG. 103.
Lepus timidus scoticus. Nat. size.

lie on inner border of crown rather than on inner side of anterior border. Anterior section of first lower premolar longer and narrower than in the related species. Other teeth not certainly distinguishable from those of *L. europæus* except that the roots of the upper cheek-teeth extend further into the orbital cavity; distance from crown of third premolar to upper surface of root capsule usually greater than alveolar length of tooth-row.

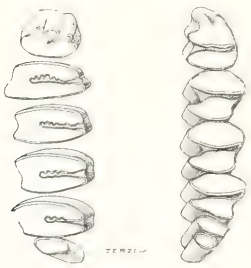

FIG. 104.
Lepus timidus. Teeth. × 2.

Remarks.—As a group the varying hares are readily distinguishable from the other European members of the genus by their shorter ears and tail, on both of which the dark markings are reduced in extent, and by their slight but evident cranial and dental peculiarities. That these more fundamental characters indicate a higher degree of specialization than that attained by *Lepus europæus* has been shown by Winge (Danmarks Fauna, Pattedyr, p. 58, 1908). *Lepus timidus* is represented in Europe by three local forms, which, though isolated geographically, seem most conveniently treated as subspecies. The Irish hare is completely differentiated from the continental and British forms.

LEPUS TIMIDUS TIMIDUS Linnæus.

1758. [*Lepus*] *timidus* Linnæus, Syst. Nat., I, 10th ed., p. 57.

1777. [*Lepus timidus*] *alpinus* Erxleben, Syst. Regni Anim., I, p. 328 (the varying hares in general, from Switzerland to Greenland). Not of Pallas, 1773, or of Erxleben, p. 337.

1778. *Lepus variabilis* Pallas, Nov. Sp. Quadr. Glir. Ord., p. 2 (Renaming of *timidus*).

1778. [*Lepus*] *alyidus* Pallas, Nov. Sp. Quadr. Glir. Ord., p. 2 (Alternative for *alpinus* Pennant).

1778. [*Lepus*] *borealis* Pallas, Nov. Sp. Quadr. Glir. Ord., p. 2 (Alternative for *alpinus* Pennant).

1795. *L*[*epus*] *septentrionalis* Link, Beyträge zur Naturgesch., Bd. I, Stück 2, p. 73 (Substitute for *variabilis*).

1820. *Lepus borealis* Nilsson, Skand. Fauna, I, p. 211 (Substitute for *variabilis*).

1827. [*Lepus timidus*] *β alba* Billberg, Synopsis Faunæ Scandinaviæ, p. 7 (Northern Scandinavia). Not *L. timidus albus* Bechstein, 1801.

1829–32. *Lepus borealis collinus* Nilsson, Illum. Fig. Skand. Fauna, I, pl. 19 (Södermanland, Sweden).

1829–32. *Lepus borealis sylvaticus* Nilsson, Illum. Fig. Skand. Fauna, I, pl. 22 (Heavily wooded portions of Sweden).

1844. *Lepus canescens* Nilsson, Öfversigt af Kongl. Vetensk.-Akad. Förhandl., Stockholm, I, p. 133 (Renaming of *sylvaticus*).

1857. *Lepus variabilis* b. Form der Mittelregion und der Alpen, Blasius, Säugethiere Deutschlands, p. 424 (part).

1910. *Lepus timidus* and *L. timidus collinus* Trouessart, Faune Mamm. d'Europe, p. 216.

Type locality.—Upsala, Sweden.

Geographical distribution.—Scandinavian Peninsula.

Diagnosis.—Largest of the varying hares of western Europe, the occipitonasal length of adult skulls ranging from 95 to 103 mm.

Measurements.—Adult from Helsingland, Sweden : hind foot, 150 ; ear, 94. Adult male from Stockholm, Sweden : hind foot, 155 ; ear from crown, 105. Adult male from Hellestad, Ostergötland, Sweden : hind foot, 151 ; ear from crown, 99. For cranial measurements see Table, p. 532.

Specimens examined.—Thirty-two, from the following localities :—

Sweden : Helsingland, 1 (U.S.N.M.); Kronön, Vesterbotten, 7 (U.S.N.M.); northern Sweden, no exact locality, 1 skeleton (U.S.N.M.); near Stockholm, 1 (U.S.N.M.); Furusund, Stockholm, 13 (U.S.N.M.); Hellestad, Ostergötland, 1 (U.S.N.M.); Lund, Skåne, 1 (U.S.N.M.); no exact locality, 1.

Norway : Hammerfest, 1; Enebek, 1; Eidsvold, Christiania, 2; near Christiania, 1; Jæderen, Stavanger, 1; Holme, Mandal, 2.

Remarks.—The typical form of *Lepus timidus* is readily distinguishable from the Alpine and Scotch races by its larger size, particularly as shown by the length of the skull. Whether more than one local race should be recognized among the Scandinavian members of the species must still be regarded as an open question owing to the absence of adequate material. It appears to be a fact, however, that the grey winter coat, though not invariably assumed by the animals of the region where it occurs, is met with nowhere except in southern Sweden and the extreme south of Norway west to Jæderen. Correlated with the occurrence of the grey winter coat appears to be the tendency for the black at tip of ear to spread downward from the rim and form a noticeable patch on outer surface. The names *sylvaticus* and *canescens* of Nilsson were based on the southern animal, while the *borealis* and *collinus* of the same author were applied to the northern form.*

1.	Sweden.	Stockholm Museum (E).	46. 6. 2. 73.
♂.	Enebek, Norway.	Christiania Museum (E).	93. 3. 1. 21.
2 ♂.	Eidsvold, Christiania.	Christiania Museum (E).	0. 2. 7. 1–2.
♂.	Christiania.	Christiania Museum (E).	93. 3. 1. 20.
♂.	Jæderen, Stavanger.	Christiania Museum (E).	0. 5. 2. 2.
♂ juv, ♀.	Holme, Mandal.	R. J. Cuninghame (C & P).	8. 8. 9. 38–39.

* A good account of the two races is given by Collett, Norges Pattedyr, pp. 58–59, 1911.

Lepus timidus varronis Miller.

1857. [*Lepus variabilis*] b. Form der Mittelregion und der Alpen, Blasius, Säugethiere Deutschlands, p. 424 (part).

1901. *Lepus varronis* Miller, Proc. Biol. Soc., Washington, xiv, p. 97, June 27, 1901. Type in U.S. National Museum.

1906. *L[epus] m[edius] varronis* Hilzheimer, Zool. Anzeiger, xxx, p. 511, August 14, 1906.

1906. *L[epus] m[edius] breviauritus* Hilzheimer, Zool. Anzeiger, xxx, p. 511, August 14, 1906 (Bernese Alps, Switzerland). With regard to status see Mottaz, Bull. Soc. Zool. de Genève, 1908, pp. 172–174, November 15, 1908.

1910. *Lepus medius varronis* Trouessart, Faune Mamm. d'Europe, p. 218.

Type locality.—Hinzenberg, Grisons, Switzerland.

Geographical distribution.—Alps and adjacent mountain chains, mostly at elevations above 1,300 m.

Diagnosis.—Decidedly smaller than *Lepus timidus timidus*, the occipitonasal length of skull rarely if ever reaching 95 mm. (usually 85 to 93 mm.); summer pelage lighter and more greyish; winter pelage always white, the middle of back usually with a faint greyish wash; anterior portion of outer border of ear nearly always buffy grey; black area at tip of ear confined to rim.

Measurements.—Type (adult male): head and body, 582; tail, 53; hind foot, 144·6; ear from crown, 106. Two adult males from Grisons, Switzerland: head and body, 570 and 585; tail, 65 and 50; hind foot, 148 and 141; ear from crown, 98 and 101. Two adult females from the same region: head and body, 575 and 610; tail, 55 and 56; hind foot, 146 and 142; ear from crown, 100·5 and 99. Adult female from Padola, Cadore, Italy: hind foot, 142; ear from crown, 101. Two males from Col-de-Vars, Hautes-Alpes, France: hind foot, 138 and 139. For cranial measurements see Table, p. 533.

Specimens examined:—Twenty-four, from the following localities:—

France: Col-de-Vars, Hautes-Alpes, 2; above Barcelonnette, Basses-Alpes, 2 (Mottaz); Petit Bornand, Haute-Savoie, 2 (Mottaz).

Switzerland: Canton St. Gallen, 3; Hinzenberg, Grisons, 1 (U.S.N.M.); Lugnetz, Grisons, 2 (U.S.N.M.); Obersaxen, Grisons, 1 (U.S.N.M.); Untervatz, Grisons, 1 (U.S.N.M); Grisons, no exact locality, 5 (B.M. and U.S.N.M.); Centovalli, Ticino, 1 (U.S.N.M.); San Lucio, Val Colla, Ticino, 1 (U.S.N.M.).

Italy: Padola, Cadore, 2 (Turin); Dronero, Cuneo, 1.

Remarks.—The Alpine varying hare is a strongly characterized race, which should perhaps be treated as a species distinct from *Lepus timidus*. The winter coat appears to be always white or incompletely white; a special blue grey winter pelage like that of "*sylvaticus*" is unknown.

2 ♂.	Col-de-Vars, Hautes-Alpes, France. (*C. Mottaz.*)	O. Thomas (P).	8. 8. 10. 131–132.
♀.	St. Gallen, Switzerland. (*E. H. Zollikofer.*)	O. Thomas (P).	2. 8. 4. 52.
♂, 2 ♀	Grisons. (*E. H. Zollikofer.*)	O. Thomas (P).	2. 8. 4. 49–51.
1.	Dronero, Cuneo, Italy.	W. Playters Stark (C & P).	11. 1. 2. 111.

LEPUS TIMIDUS SCOTICUS Hilzheimer.

1816. ? *Lepus albus* Leach, Syst. Catal. Spec. Indig. Mamm. and Birds, Brit. Mus., p. 7 (nomen nudum: "White Hare"). Not *Lepus timidus albus* Bechstein, 1801.

1833. *Lepus albus* Jenyns, Man. Brit. Vert. Anim., p. 35. Not *Lepus timidus albus* Bechstein, 1801.

1857. [*Lepus variabilis*] b. Form der Mittelregion und der Alpen, Blasius, Säugethiere Deutschlands, p. 424 (part).

1900. *Lepus timidus typicus* Barrett-Hamilton, Proc. Zool. Soc., London, p. 88 (part).

1906. *L[epus] m[edius] scoticus* Hilzheimer, Zool. Anzeiger, XXX, p. 511, August 14, 1906.

1910. *Lepus timidus scoticus* Trouessart, Faune Mamm. d'Europe, p. 218.

Type locality.—Northern Scotland.

Geographical distribution.—Highlands of Scotland; range now extended by artificial introduction irregularly into Wales and northern England, also in Ireland.

Diagnosis.—Size even less than in *Lepus timidus varronis*, the occipitonasal length of fully adult skulls ranging from 83 to 89 mm.; ear shorter than in *varronis*, its length from crown 80 to 90 mm., instead of 90 to 100 mm.; winter pelage white, but apparently never without some trace of grey.

Colour. Summer pelage essentially indistinguishable from that of *Lepus timidus timidus*, though perhaps not attaining the same degree of sepia brown as in extreme specimens of the Scandinavian race, and underparts usually more buffy, the interramia less contrasted with collar. Winter pelage apparently never clear white, the middle of back in all the specimens examined showing at least a faint grey tinge as compared with the snowy white of thighs and tail, this grey usually suffusing the entire dorsal surface. It is produced by the presence among the white hairs of a few that are entirely black, and others that are black with a light cream-buff sub-terminal annulation as in summer pelage. Underfur very pale buff, this colour appearing at surface when hairs are disarranged. Ear with anterior outer surface conspicuously grizzled (much more than in *varronis*), though usually paler than in summer, the basal half often mostly white. Sides of muzzle usually tinged with buffy.

Skull and teeth.—The skull is immediately distinguishable from those of the other European forms of *Lepus timidus* by its small size. The teeth show no tangible peculiarities.

Measurements.—Adult male and female from Cromlix, Dunblane, Perthshire: head and body, 482 and 480; tail, 63 and 57; hind foot, 130 and 132; ear from crown, 85 and 83. Adult male from Altyre, Morayshire: head and body, 501; tail, 57; hind foot, 131; ear from crown, 90. Adult from New Galloway, Kirkcudbright: head and body, 535; tail, 58; hind

foot, 133 ; ear from crown, 77. For cranial measurements see Table, p. 533.

Specimens examined.—Forty, from the following localities in Scotland: Borgie, Sutherland, 1; Nairn, 5; Forres, Elgin, 1; Altyre, Morayshire, 5; Dallas, Morayshire, 2; Morayshire, 3; Glengroullie, 3; Cromlix, Dunblane, Perthshire, 8; Caparoch, Selkirkshire, 1; Thornhill, Dumfriesshire, 2; New Galloway, Kirkcudbright, 2; Clonas, 4; no exact locality, 3 (B.M. and U.S.N.M.).

Remarks.—While readily distinguishable from true *Lepus timidus* by its smaller skull, the Scotch hare rather closely resembles the Alpine race. Its ears are, however, noticeably shorter, and the winter pelage rarely if ever becomes so nearly pure white. As in *L. timidus varronis* no special grey winter coat is known.

Individuals supposed to be hybrids between this animal and *Lepus europæus occidentalis* are sometimes unusually heavy examples of *scoticus*, and in other instances *occidentalis* in grey winter pelage. After eliminating these, however, a few specimens remain in which the characters of the two animals appear to be blended. The British Museum contains three such skins.* In each of these the ear is longer than in *scoticus*, and its colour pattern nearly as in *occidentalis*, though less distinct; the tail is short as in *scoticus*, but its dorsal surface has a nearly black median area; in two the body colour is intermediate between that of the supposed parent species in summer coat, while in the other (No. 63. 8. 23. 1) it more nearly approaches that of the common hare.†

1.	Borgie, Sutherlandshire, Scotland.	Rev. H. H. Slater (C & P).	0. 2. 24. 3.
♂, 2 ♀.	Nairn.	Earl Cawdor (P).	98. 11. 21. 1–3. 99. 5. 1. 1–2.
1.	Knockie, Inverness-shire.	E. Hargitt (P).	86. 9. 9. 3.
1.	Forres, Elginshire.	Sir W. Gordon Cumming (P).	3. 1. 27. 1.
4 ♂, 1 ♀.	Altyre, Morayshire.	Sir W. Gordon Cumming (P).	93. 12. 4. 1–3. 94. 2. 15. 1–2.
3 st.	Morayshire.	Sir W. Gordon Cumming (P).	97. 12. 27. 1–3.
2 st.	Dallas, Morayshire.	Sir W. Gordon Cumming (P).	1. 1. 15. 1–2.
3.	Glengroullie.	Earl Cawdor (P).	99. 3. 20. 1–3.
6 ♂, 2 ♀.	Dunblane, Perthshire.	Capt. Hon. A. Hay Drummond (P).	92. 2. 15. 2–5. 97. 5. 13. 1–3.
2.	Selkirkshire.	Rev. H. H. Slater (C & P).	0. 2. 24. 2–3.

* No. 63. 8. 23. 1. No history.
No. 2. 11. 28. 1. Male, Craigmyle, Aberdeenshire, Scotland.
No. 6. 12. 26. 1. Male, Capenoch, Thornhill, Dumfriesshire, H. S. Gladstone.

† Swedish specimens combining the characters of *timidus* and *europæus* have been described and figured by Lönnberg, Proc. Zool. Soc., London, 1905, II., pp. 278–287.

1.	Thornhill, Dumfriesshire.	H. S. Gladstone (C & P).	7. 8. 7. 1.
2.	New Galloway, Kircudbrightshire.	Col. Gordon Maitland (C & P).	95. 10. 6. 1–2.
♂, 3 ♀.	Clonas.	W. R. Ogilvie-Grant (P).	99. 2. 17. 1–4.

LEPUS HIBERNICUS Bell.

1833. *Irish Hare* Yarrell, Proc. Zool. Soc., London, p. 88. No technical name.

1837. *Lepus hibernicus* Bell, History of Brit. Quadrupeds, p. 341.

1857. [*Lepus variabilis* a. Form der wärmeren Klimate, Blasius, Säugethiere Deutschlands, p. 424 (part).

1900. *Lepus timidus hibernicus* Barrett-Hamilton, Proc. Zool. Soc., London, p. 89.

1900. *Lepus timidus lutescens* Barrett-Hamilton, Proc. Zool. Soc., London, p. 89 (Donobate, Co. Dublin, Ireland). Type in British Museum.

1906. *L*[*epus*] *t*[*imidus*] *hibernicus* Hilzheimer, Zool. Anzeiger, xxx, p. 510, August 14, 1906.

1910. *Lepus timidus hibernicus* and *L. timidus lutescens* Trouessart, Faune Mamm. d'Europe, p. 216.

Type locality.—Ireland.

Geographical distribution.—Ireland, chiefly in the more hilly districts. Now introduced and established in portions of Wales and Scotland (Carnarvonshire and the island of Mull).

Diagnosis.—Differing from the other European members of the *Lepus timidus* group in its strongly russet colour and in the partial or complete absence of the white winter coat. Size noticeably greater than in its nearest geographical ally, *L. timidus scoticus*.

Colour.—General colour of upper parts a finely and inconspicuously grizzled russet brown, approaching the russet and wood-brown of Ridgway, brighter and more reddish on shoulders and back, paler, though strongly russet, on crown and face, duller and fading to ochraceous-buff on cheeks, sides, and outer surface of legs; nape and back of neck to between shoulders scarcely grizzled, the nape usually with a suffusion of drab. The colours on the back are arranged as follows: underfur (15 mm.) light pearl-grey (about grey No. 10 of Ridgway) at base, the terminal half of the hairs abruptly light russet; longer hairs (25 mm.) light pearl-grey at extreme base, becoming black at level of russet portion of shorter hairs, each with a dull buff subterminal annulation about 4 mm. long and a rather shorter black tip; a few still longer hairs (35 mm.) entirely black except the grey base. Rump usually with an evident greyish cast, this often rather conspicuous in winter specimens, the black tips to the hairs occasionally producing a markedly clouded effect. Tail white, usually with a bluish tinge, the upper surface sprinkled to a varying degree with blackish or brownish hairs, these occasionally producing a decided grizzled effect, and never

CRANIAL MEASUREMENTS OF *LEPUS TIMIDUS* GROUP.

Locality.	Number.	Sex.	Occipitonasal length.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Postorbital constriction.	Breadth of brain-case.	Nasal (diagonal).	Greatest breadth of both nasals together.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.
L. timidus timidus.														
Sweden: Kronön	155488	*	97·0	89·4	52·0	24·8	17·0	34·6	42·0	22·4	28·2	78·4	19·4	20·6
..	155493	*	96·4	87·4	—	24·0	17·2	34·0	39·6	19·0	27·0	74·8	18 2	19·6
Furusund	155496	♂*	98·8	90·2	48·6	20·2	15·2	35·4	42·0	20·6	28·6	77·4	18·6	19·0
..	155497	♂*	95·4	88·0	48·2	23·2	15·8	32·6	42·4	22·6	27·4	75·6	18·0	19·2
..	155498	♂	—	85·0	46·6	20·6	15·4	33·6	—	20·4	26·2	73·6	18·8	19·8
..	155499	♀	98·2	89·8	50·2	24·2	16·4	33·6	43·4	22·4	28·4	77·4	18·4	19·4
..	155500	♀	100·2	90·6	49·2	23·0	15·0	34·0	42·0	21·8	29·6	78·0	18·4	19·6
..	155502	♀*	99·4	89·6	49·4	23·2	15·6	33·2	43·2	21·4	28·2	77·2	18·8	19·4
..	155503	♀*	96·2	87·0	49·2	22·0	15·4	32·2	40·6	20·8	27·0	76·0	18·4	18·8
..	155504	♀*	97±	89·2	—	21·8	17·4	34·4	43·0	20·2	29·0	75·2	18·0	19·6
..	155505	♀	97·4	90·6	49·4	23·0	16·2	33·8	41·4	21·4	28·0	76·2	18·6	19·2
Stockholm	37136	♀	99·2	91·0	50·2	26·2	16·8	33·2	40·2	21·2	28·6	78·0	18·8	20·0
Hellestad	37135	♂	103·0	91·8	52·6	25·8	16·8	33·6	45·8	22·6	30·6	79·8	19·8	20·2

L. timidus scoticus.															
Scotland: Clonas . . .	99. 2. 17. 1	♂*	87·0	79·0	45·0	20·0	15·0	31·0	38·0	19·0	26·4	69·0	18·0	20·0
Cawdor, Nairn . .	98. 11. 21. 2	♂*	89·0	81·0	45·0	18·0	15·6	30·6	38·6	18·4	26·4	68·8	17·0	17·8
Cromlix . . .	97. 10. 18. 1	♂*	87·4	80·0	45·4	19·8	16·0	32·6	36·0	19·0	24·0	66·4	18·0	19·2
,, . . .	97. 2. 13. 2	♂*	86·6	79·4	—	—	—	—	36·2	21·2	26·2	67·6	17·8	18·6
,, . . .	97. 2. 15. 2	♂*	83·6	76·0	44·6	22·2	16·0	30·4	36·6	19·6	23·2	66·4	16·6	17·2
,, . . .	97. 2. 15. 3	♀	86·0	78·6	43·0	19·4	16·2	30·0	38·8	18·2	25·0	66·8	17·4	18·0
Altyre, Morayshire .	94. 2. 15. 2	♀*	88·0	81·0	46·0	19·0	16·2	31·4	39·0	17·6	25·4	—	18·0	—
,, ,, .	93. 12. 4. 2	♂*	88·0	79·2	46·4	17·4	16·4	31·8	38·2	18·0	25·6	70·4	17·2	18·2
,, ,, .	94. 2. 15. 1	♂*	88·2	78·6	47·4	21·2	16·2	33·0	39·0	19·8	24·8	70·0	18·2	18·8
L. timidus varronis.															
France: Hautes-Alpes . .	1203 Mottaz	♂	89·0	81·0	45·0	21·6	16·0	32·4	39·0	21·0	26·0	70·0	16·8	17·2
Petit Bornand, Haute-Savoie . . .	1027 ,,	♂	92·0	82·0	45·0	23·0	15·0	33·2	39·0	21·0	26·0	69·6	16·6	16·4
Switzerland: Heinzenberg, Grisons	105832†	♂	91·4	80·0	45·6	21·8	15·8	30·8	39·2	18·8	26·2	68·6	16·4	17·8
Werdenberg, ,,	2. 8. 4. 52	♀*	91·4	82·4	45·6	20·8	15·4	31·8	38·4	19·6	25·4	69·6	16·8	17·8
Lugnetz, ,,	105834	♂	92·4	83·8	46·0	20·0	15·8	33·8	40·2	21·2	27·2	69·0	17·6	18·4
Grisons . . .	115223	♀	89·8	79·6	45·8	22·4	13·6	32·6	37·0	18·8	25·6	67·2	16·8	17·8
,, . . .	115226	♀	91·8	83·6	46·8	20·8	—	31·4	38·4	17·8	26·8	71·8	17·8	19·0
Italy: Padola, Cadore . .	5104 Turin	♀	93·0	84·0	47·0	18·2	14·0	32·0	37·0	19·0	27·6	74·0	17·0	18·0
L. hibernicus.															
Ireland: Templemoore . .	76. 5. 8. 1	♂	91·0	82·0	44·4	22·6	15 0	32·0	41·0	20·8	26·0	—	18·6	18·6
,, . . .	76. 9. 7. 2	♂	94·0	85·0	45·6	22·0	16·8	32·4	42·0	20·8	26·4	73·4	18·6	19·0
,, . . .	76. 11. 18. 2	♀	94·0	85·0	45·4	22·0	17·6	33·0	39·4	19·4	26·2	—	18·0	—
Vaynol Park . . .	3. 1. 28. 1	*	98·6	86·0	48·4	23·4	14·0	33·8	42·4	20·2	28·4	—	18·8	—

* Old.

† Type.

entirely absent. Ear grizzled ochraceous-buff, rimmed with black at tip, the inner surface becoming clear ochraceous-buff sub-terminally, the posterior outer surface washed with grey, and with a buffy or whitish border from base to black terminal area; anterior border occasionally whitish near middle. A faintly defined pale eye-ring, but no other light markings on side of head. Inner surface of legs and entire underparts (except collar) white, slightly tinged with buffy, especially on inner side of thigh; inguinal region slightly clouded with a mixture of blackish and buffy; collar between ochraceous-buff and clay-colour though paler than either, the grey (about No. 7 of Ridgway) underfur appearing irregularly at surface. Feet ochraceous-buff, duller and somewhat grizzled on metapodials, clear and brighter on toes. Soles an indefinite buffy drab.

Skull and teeth.—The skull differs from that of *Lepus timidus scoticus* in the larger sizes attained by fully adult individuals, the occipitonasal length in such specimens ranging from 91 to 94 mm., while in the Scotch hare it seldom exceeds 88 mm. Similarly the mandible in *hibernicus* is usually more than 70 mm. in length, while in *scoticus* it rarely if ever reaches 70 mm. The brain-case in the Irish hare often appears more elongate than in the Scotch form, but the difference is not constant. Otherwise I can detect no cranial or dental peculiarities by which the two species may be distinguished.

Measurements.—Adult female from Arthurstown, Waterford, Ireland: head and body, 517; tail, 40; hind foot, 139. Average and extremes of six specimens from Lisduff, Co. Cavan: ear from crown, 90·3 (85–95). For cranial measurements see Table, p. 533.

Specimens examined. Twenty-nine, from the following localities:—
Ireland: Gosford Castle, Armagh, 2; Lisduff, Co. Cavan, 12; Rathrobbin, King's County, 2; Arthurstown, Waterford, 1; Kilmanock, Waterford, 8; no exact locality, 2. Donobale, Dublin, 1 (type of *lutescens*).
Wales: Vaynol Park, near Bangor, Carnarvonshire, 1 (introduced).

Remarks.—The Irish hare is strikingly different from the other European members of the *timidus* group in its peculiar russet colour. In size it noticeably exceeds the Scotch hare, but is itself surpassed by the Scandinavian true *timidus*. The yellowish specimens from Co. Dublin, to which the name *lutescens* has been applied, occurring, as they do, together with animals of normal colour, appear to be examples of some pathological or dichromatic condition rather than the representatives of a recognizable geographic race.

2.	Gosford Castle, Armagh, Ireland.	Hon. L. Powys (c & p).	76. 1. 25. 1–2.
4.	Lisduff, Cavan.	Hon. B. E. B. Fitzpatrick (c & p).	76. 3. 26. 1–2. 76. 5. 8. 1-2.
4.	Lisduff, Cavan.	Hon. B. E. B. Fitzpatrick (c & p).	76. 7. 12. 1–2. 76. 9. 7. 1–2.

4.	Lisduff, Cavan.	Hon. B. E. B. Fitzpatrick (c & p).	76. 11. 18. 1–2. 77. 1. 18. 1–2.
2 ♂, st.	Rathrobbin, King's County.	Col. M. W. Biddulph (c & p).	98. 2. 10. 1 2.
st.	Donabale, Dublin.	Charles Cobbe (c & p). (*Type* of *L. lutescens* Barrett-Hamilton.)	82. 2. 4. 1.
3.	Kilmanock, Waterford.	G. Barrett-Hamilton (c & p).	99. 2. 16. 1–3.
2 ♂, ♀.	Kilmanock, Waterford.	G. Barrett-Hamilton (c & p).	9. 12. 15. 1 3.
♂, ♀.	Waterford.	G. Barrett-Hamilton (c & p).	9. 10. 4. 1. 8. 2. 27. 1.
1.	Bangor, Carnarvonshire, Wales.	G. W. Assheton Smith (c & p).	3. 1. 28. 1.

Sub-Order **SIMPLICIDENTATA.**

1891. *Simplicidentata* Flower and Lydekker, Mammals, Living and Extinct, p. 448.

Geographical distribution. — Same as that of the order *Rodentia.*

Characters.—Upper incisors 1–1, their enamel covering not extending to posterior surface; distance between mandibular and maxillary tooth-rows approximately equal, both pairs of rows capable of opposition at the same time, the primary motion of the jaws in mastication longitudinal or oblique; premolars never more than $\frac{2}{1}\ \frac{2}{1}$; incisive foramina moderate or small, not confluent posteriorly; bony palate never reduced to a narrow bridge between premolars; facial portion of maxillary entire; fibula not articulating with calcaneum.

Remarks.—This sub-order contains the vast majority of existing rodents, among which about twenty families are now recognized. Eight of these occur in Europe (for keys see pp. 481–483).

Family ZAPODIDÆ.

1875. *Zapodidæ* Coues, Bull. U.S. Geol. and Geogr. Surv. Terr., 2d ser., I, p. 253.

1901. *Zapodidæ* Lyon, Proc. U.S. Nat. Mus. XXXIII, p. 666, May 2, 1901.

Geographical distribution.—Boreal portions of both hemispheres, east in Europe to Norway.

Characters.—Skull and teeth with a general resemblance to those of the *Dipodidæ* though less highly modified; but infraorbital foramen similarly large and with distinct supplemental canal along inner border, and jugal in contact with lachrymal; hind legs much less specialized than in the related family, the foot with five distinct metatarsals.

Remarks.—The family *Zapodidæ*, though related to the

Dipodidæ,* is readily distinguished by the more primitive murine character of the skull and hind foot. It is divisible into two main groups, the *Zapodinæ* with two genera in North America and one in China, and the *Sicistinæ* with a single genus peculiar to the Old World.

Sub-Family SICISTINÆ.

1857. *Murina* Blasius, Säugethiere Deutschlands, p. 299 (part).
1887. *Sminthi* (section of *Dipodini*) Winge, Jordfundne og nulevende Gnavere (*Rodentia*) fra Lagoa Santa, Minas Geraes, Brasilien, p. 122.
1901. *Sminthinæ* Lyon, Proc. U.S. Nat. Mus. xxxiii, p. 666, May 2, 1901.

Geographical distribution.—Boreal portion of eastern hemisphere, exact limits of range not known; in Europe west to Norway.

Characters.—Form strictly murine, the hind legs not elongated, cheek-teeth tuberculate.

Remarks.—The sub-family *Sicistinæ*, a strictly Old World group less specialized than the *Zapodinæ*, contains the single genus *Sicista*, two members of which occur in Europe.

Genus **SICISTA** Gray.

1827. *Sicista* Gray, Griffith's Cuvier, Animal Kingdom, v, p. 227 (*Mus subtilis* Pallas).
1839. *Sminthus* Nathusius in Nordmann, Demidoff's Voyage dans la Russie Méridionale, iii, p. 49 (*S. loriger* Nordmann).
1857. *Sminthus* Blasius, Säugethiere Deutschlands, p. 301.
1901. *Sicista* Allen, Proc. Biol. Soc. Washington, xiv, p. 185, December 12, 1901.

Type species.—*Mus subtilis* Pallas.

Geographical distribution.—From central Asia to Denmark and southern Norway. Details of distribution imperfectly known. For the possible occurrence of a member of the genus in the Orkney Islands see Major, Zool. Garten, xlvi, pp. 129–134, May 1905.

Characters.—As in the sub-family *Sicistinæ*. Dental formula: $i\frac{1\,1}{1\,1}$, $pm\frac{1\,1}{0\,0}$, $m\frac{3\,3}{3\,3} = 18$; crowns of cheek-teeth with complicated enamel pattern which does not form transverse ridges; larger teeth with four well developed tubercles.

Remarks.—The genus *Sicista* is at once recognizable among European rodents by its murine external characters combined with the large infraorbital foramen, low-lying zygoma and 5–5 upper cheek-teeth the tubercles of which are arranged in two longitudinal series.

The species are very imperfectly known. About eight are currently recognized; two of these occur in Europe.

* Waterhouse, Ann. and Mag. Nat. Hist., x., p. 203, November, 1842.

KEY TO THE EUROPEAN SPECIES OF *SICISTA*.

Least depth of rostrum behind incisors about equal to breadth of rostrum in same region; crown area of m^1 about four times that of premolar; sides distinctly more yellow than back, with rather noticeable line of demarcation (Roumania)..... *S. loriger*, p. 537.

Least depth of rostrum behind incisors decidedly greater than breadth of rostrum in same region; crown area of m^1 about three times that of premolar; sides essentially concolor with back (Hungary, Denmark, south-eastern Norway) ..... *S. trizona*, p. 539.

SICISTA LORIGER Nathusius.

1840. *Sminthus loriger* Nathusius in Nordmann, Demidoff's Voyage dans la Russie Méridionale, III, p. 49 (Odessa).

1840. *Sminthus nordmanni* Keyserling and Blasius, Wirbelth. Europas., p. 38 (Crimea).

Type locality.—Odessa, Russia.

Geographical distribution.—South-western Russia, eastern Roumania, Bulgaria; limits of range not known.

Diagnosis.—Least depth of rostrum behind incisors about equal to width of rostrum in same region; crown area of m^1 at least four times that of premolar; sides distinctly more yellow than back, with rather well-defined line of demarcation.

External characters.—General appearance essentially as in *Mus musculus*, but size less (about as in *Mus spicilegus*), and body more slender; tail slightly longer than head and body, obscurely four-sided, the fine hairs not concealing annulations (of which there are about twenty to the centimeter at middle of tail) and not forming any decided pencil at tip; ear moderately large, extending a little beyond eye when laid forward, its outline simple, ovate, its posterior border with large thickened lobe at base, capable of completely closing the meatus, its anterior border with minute though evident sub-basal notch and projection; both surfaces of ear densely clothed with short hairs; basal lobe conspicuously tufted; anterior border of nostril thickened, a small wart beneath it; space between nostrils narrow, crossed by a well developed vertical ridge; upper lip not grooved in front; feet more slender than in *Mus musculus* and its allies, the fingers and toes longer relatively to palm and sole; front foot with thumb reduced to a mere tubercle to support the short but evident blunt nail; third digit longest, fourth slightly shorter, second extending to middle of third, fifth just beyond middle of fourth, pads as in *Mus musculus;* hind foot with relative lengths of digits as in *Mus musculus*, the second, third and fourth sub-equal and longest, fifth extending nearly to middle of fourth, first not quite to base of second; claws essentially like those of front feet; sole naked, the pads arranged as in *Mus musculus;* postero-internal tubercle extended

backward so that its length is slightly more than double its greatest width. Mammæ: p 2–2, i 2–2 = 8.

Colour.—Back a peculiar light brown perhaps best described as a buffy, greyish isabella-colour, tinged with ecru drab on sides of neck, and everywhere slightly clouded (not "lined") with black. Median dorsal region with a sharply defined black stripe about 2 mm. wide thrown into relief posteriorly by a distinct lightening of ground colour along its edges. Sides ochraceous-buff, not strongly contrasted with back, but distinctly more yellow and with rather sharply-drawn line of demarcation; below the colour of sides passes insensibly into the lighter, less yellow ochraceous-buff of belly. Ear black sprinkled with buffy hairs and with a narrow buffy edge. They are rather strongly contrasted with surrounding parts, this effect heightened by the presence of an ill-defined though evident patch behind ear. Feet a light indefinite buffy brown rather lighter than belly, the toes a little more pallid. Tail obscurely bicolor, sepia above, dull cream-buff below. Longer hairs of back black to extreme tip; basal colour everywhere slaty.

Skull and teeth.—The skull differs from that of *S. trizona*

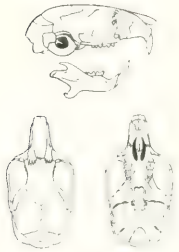

FIG. 105.

Sicista loriger. Nat. size.

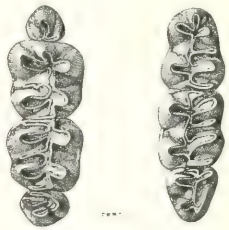

FIG. 106.

Sicista loriger. Teeth. × 9.

merely in the somewhat more slender rostrum; least depth behind incisors about equal to width in same region. Teeth as in the related species, but discrepancy in size between premolar and first molar more pronounced, the crown area of the smaller tooth about one-fourth that of the larger.

Measurements. Three adult females from Malcoci, Dobrudscha (in alcohol): head and body, 55, 56 and 58; tail, 69, 75 and 76; hind foot, 14, 15 and 15; ear from meatus, 11, 12·4 and 12. For cranial measurements see Table, p. 541.

Specimens examined. Six, five from Dobrudscha (B.M. and U.S.N.M.), and one from Bulgaria, no exact locality (Lataste).

Remarks.—The different specimens show no individual variations worthy of note. From the better-known animal of

Hungary, Denmark and Norway this species is immediately distinguishable by the contrast between the colour of sides and back.

1. Dobrudscha, Roumania. Purchased (Prulière). 86. 4. 2. 4.

SICISTA TRIZONA Petényi.

1857. *Sminthus vagus* Blasius, Säugethiere Deutschlands, p. 302 (probably not *Mus vagus* Pallas).
1882. *Mus trizonus* Petényi, Termeszetrajzi Füzetek, v, p. 103 (Hungary).
1882. *Mus interzonus* Petényi, Termeszetrajzi Füzetek, v, p. 103 (Alternative for *trizonus*).
1882. *Mus interstriatus* Petényi, Termeszetrajzi Füzetek, v, p. 103 (Alternative for *trizonus*).
1882. *Mus tripartitus* Petényi, Termeszetrajzi Füzetek, v, p. 103 (Alternative for *trizonus*).
1882. *Mus virgulosus* Petényi, Termeszetrajzi Füzetek, v, p. 103 (Alternative for *trizonus*).
1882. [*Mus*] *tristriatus* Petényi, Termeszetrajzi Füzetek, v, p. 103 (Alternative for *trizonus*).
1910. *Sicista subtilis* Trouessart, Faune Mamm. d'Europe, p. 205 (probably not *Mus subtilis* Pallas).

Type locality.—Hungary.

Geographical distribution.—Hungary; Denmark;* south-eastern Norway.† Details of distribution very imperfectly known.

Diagnosis.—Least depth of rostrum behind incisors decidedly greater than breadth of rostrum in same region; crown area of m^1 about three times that of premolar; sides essentially concolor with back.

Colour.—Back, sides and head uniform raw-umber with a slight buffy tinge, this more noticeable on cheeks and sides of neck than elsewhere; back very inconspicuously "lined" with black. The individual hairs of the underfur are slate-colour at base (5 mm.), the tips (1·5 mm.) buffy raw-umber; longer hairs (12 mm.) black, the tips (2 mm.) colourless and with a silvery gloss. Median dorsal line with clear black stripe about 3 mm. wide, extending from crown to base of tail, better defined posteriorly (except within a few mm. of base of tail) than anteriorly, but not thrown into relief by lightening of background along any part of its extent. Underparts light ochraceous-buff without line of demarcation along sides, much dulled by appearance at surface of slaty under colour. Ears essentially concolor with back, but with a stronger admixture of black, the rim clear light buffy. Feet a light indefinite buffy brown rather paler than belly, the toes still paler. Tail obscurely bicolor, sepia above, dull cream-buff below.

Skull.—In general appearance the skull suggests that of

* *See* Winge, Danmarks Fauna, Pattedyr, p. 65, 1908.
† *See* Collett, Norges Pattedyr, pp. 68–77, 1911.

Mus musculus, but brain-case more squarish in outline, rostrum slightly less elongate, and dorsal profile convex throughout, more strongly so posteriorly than anteriorly. Interparietal narrow, the lateral extremities pointed. Auditory bullæ rather large, well inflated, their greatest transverse diameter along squarely truncate anterior border. Interorbital region much broader than rostrum, nearly flat, its edges faintly angular. Zygoma abruptly spreading anteriorly, much deeper in front than behind, its lower edge horizontal and at level of alveolar line; anteorbital foramen large, much wider below than above. Rostrum sloping anteriorly, but rather narrow, the least depth just behind incisors decidedly greater than width at same region; nasals convex anteriorly, flat posteriorly, the posterior border squarely truncate at level of middle of lachrymal, the nasal branches of premaxillaries slightly longer. Incisive foramina very large, extending from about 1 mm. behind alveolus of incisor to level of front of m^1, the width of each foramen slightly greater posteriorly than anteriorly. Palate rather large, flat throughout, extending at full width conspicuously behind last molars, rather more than half of its surface formed by the palatine bones; a noticeable transverse ridge at level of middle of m^2, and high narrow longitudinal ridge extending from this to posterior border of palate; mesopterygoid space about one-half longer than broad, nearly parallel sided, the hamulars slightly bowed outward and coming in contact with antero-internal angle of bullæ; ectopterygoid well developed, forming a conspicuous, nearly horizontal plate, the rather large pterygoid fossa, therefore, shallow. Mandible slender, with no special peculiarities, the well developed coronoid process rising a little above level of condyle; angular process long, concave on inner side, the lower border bent abruptly upward and outward at nearly a right angle.

Teeth.—Upper premolar single-rooted, the crown terete, with high, narrow antero-external cusp, and low ridge-like internal cusp, the three cusps separated by two evident furrows. Its area is about one-third that of succeeding tooth. First upper molar 3-rooted, the general outline of crown squarish, slightly longer than wide and slightly wider externally than internally; enamel of crown thrown into four main cusp-like folds, the outer of which are larger than the inner, and three secondary folds extending outward between and alternating with outer cusps. Second molar like first but slightly longer and a little narrower in proportion to its width. Third molar slightly larger than premolar, and of about the same shape, the two anterior cusps small but evident, the two posterior scarcely more than slight elevations on rim of tooth. Lower molars essentially like the upper teeth, but crowns longer and less squarish in outline, and pattern of folding reversed, the intermediate folds extending inward instead of outward. Third lower molar larger than the corresponding upper tooth.

CRANIAL MEASUREMENTS OF *SICISTA LORIGER* AND *S. TRIZONA*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Breadth of brain-case.	Depth of brain-case at middle.	Nasal.	Least depth of rostrum behind incisors.	Breadth of rostrum behind incisors.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
S. loriger.															
Dobrudscha . .	86. 4. 2. 4		—	—	3·6	—	—	7·0	2·6	2·8	5·0	10·4	3·0	2·8	Teeth moderately worn.
,, Malcoci	122117	♀	18·2	—	3·8	8·8	6·2		2·8	2·8	5·0	10·6	3·2	3·0	,, slightly worn.
,, ,,	122118	♀	—	—	—	—	—	—	2·8	2·8	4·8	10·6	3·0	3·0	,, ,,
S. trizona.															
Austria-Hungary: Tatra Mts. . .	87. 1. 4. 1	♀	17·8	9·8	3·8	9·0	6·4	—	—	—	4·8	9·8	3·0	2·8	,, ,,
,, ,,	91. 1. 21. 3	♀	—	—	3·8	9·0	—	8·8	3·0	2·6	4·8	—	3·0	2·8	,, moderately worn.
Austria-Hungary: Zubereé . .	94. 3. 1. 74		—	—	3·8	—	—	7·4	3·0	2·6	4·8	10·0	3·0	2·8	,, slightly worn.
Denmark: Vestervig.	88. 1. 9. 1	♂	17·8	10·0	4·0	8·8	6·6	7·4	3·2	2·8	4·8	10·2	3·0	2·8	,, ,,

Measurements.—Adult male from Vestervig, Denmark : head and body, 65 ; tail, 87 : hind foot, 16·4 ; ear from meatus, 10·6. For cranial measurements see Table, p. 541.

Specimens examined.—Five, from the following localities :—
Austria-Hungary : Zubereč, northern Hungary, 2 ; Tatra Mts., northern Hungary, 2.
Denmark : Vestervig, Thy, 1.

Remarks.—Until it is possible to compare the two European species of *Sicista* with authentic specimens of the Asiatic forms named by Pallas it seems preferable to use the names *trizona* and *loriger*, the status of which admits of no doubt.

2.	Zubereč, Hungary.	Budapest Museum (E).	94. 3. 1. 73-74.
1 al.	Tatra Mountains.	Zoological Society.	87. 1. 4. 1.
1 al.	Tatra Mountains.	Dr. R. Collett (P).	91. 1. 21. 3.
1 al.	Vestervig, Thy, Denmark.	Copenhagen Museum (E).	88. 1. 9. 1.

Family HYSTRICIDÆ.

1821. *Hystridæ* Gray, London Med. Repos., xv, p. 304, April 1, 1821.
1831. *Hystricidæ* Burnett, Quart. Journ. Sci. Lit. and Art, xxviii, 1829, p. 350, 1830.

Geographical distribution. Warmer portions of the Old World, Madagascar, Australia and the outer portions of the Malay Archipelago excepted. In Europe confined to the Mediterranean region.

Characters. Middle portion of zygoma formed exclusively by the large jugal bone which does not come in contact with lachrymal ; anteorbital foramen large, without secondary canal ; mandible with angular part arising from outer side of alveolus of incisor ; frontal region of skull inflated (especially in genus occurring in Europe) ; clavicle incomplete ; tibia and fibula distinct ; teeth hypsodont, incompletely rooted ; body heavy, covered with long quills.

Remarks. The family *Hystricidæ* contains four or five genera, one of which reaches the Mediterranean region of Europe.

Genus **HYSTRIX** Linnæus.

1758. *Hystrix* Linnæus, Syst. Nat., i, 10th ed., p. 56 (*cristata* by tautonymy).
1798. *Histrix* Cuvier, Tabl. Élément. de l'Hist. Nat. der Anim., p. 170 (Modification of *Hystrix*).
1866. *Œdocephalus* Gray, Proc. Zool. Soc. London, p. 308 (*Acanthion cuvieri* Gray).

Type species. Hystrix cristata Linnæus.

Geographical distribution. Africa and locally in Mediterranean region of Europe.

Characters. Inflation of facial region of skull maximum for the family, the contrast between depth at front of tooth-row and that behind alveolus of incisor very conspicuous ; nasal bones

extending back to glenoid level, their median length about three times that of frontals, the posterior margin of the two together forming a broad, even curve; dental formula: $i \frac{1}{1}, pm \frac{1}{1}, m \frac{3}{3}$ = 20; tail short; neck with conspicuous crest of long coarse bristles.

Remarks.—The genus *Hystrix* as here restricted contains the African and Italian species only. Several forms have been described, the status of which is imperfectly understood. One occurs in Europe.

HYSTRIX CRISTATA Linnæus.

1758. [*Hystrix*] *cristata* Linnæus, Syst. Nat., I, 10th ed., p. 56 (near Rome, Italy).

1792. *H*[*ystrix*] *cristata europæa* Kerr, Anim. Kingd., p. 213 (Renaming of *cristata*).

1839. ? [*Hystrix cristata*] var. *alba* De Sélys-Longchamps, Études de Micromamm., p. 152 (nomen nudum).

1910. *Hystrix cristata* Trouessart, Faune Mamm. d'Europe, p. 212.

Type locality.—Near Rome, Italy.*

Geographical distribution.—Northern Africa; central and southern Italy; Sicily. (Wrongly attributed to the Iberian Peninsula.) †

Diagnosis.—General characters as in the genus *Hystrix*; size medium, the condylobasal length of skull about 130 mm., depth of skull at front of tooth-row about 50 mm.

External characters.—Form heavy, the body appearing much larger posteriorly than anteriorly on account of the mass of specially elongated quills on posterior half of back; head short, the eye rather large, the ear low and inconspicuous; legs short; feet broad; tail shorter than hind foot, though bearing a dense mass of quills which make it appear much longer. Head rather short and deep; ear low, rounded, overlaid by the bristle-like hairs springing from region above and behind eye, a small but evident lobe in front of meatus; muzzle pad and median portion of upper lip finely pubescent with fine and short but rather stiff hairs; nostrils situated in a deep groove crossing muzzle horizontally; upper lip with narrow median cleft. Front foot short and broad, with four short, well developed digits and a rudimentary thumb, the two median digits longest and bearing the largest claws, the second and fifth successively shorter, all four with strong slightly curved claws, the thumb a mere tubercle covered on its upper surface by the rudimentary nail; palm

* The statement "Habitat in Asia" is merely equivalent to saying that the animal is foreign. The reference to the Systema [4th ed.], p. 9, No. 1, leads directly to Ray (Syn. Meth. Anim. Quadr., p. 209), whose account is based on a specimen from the mountainous districts near Rome (see Thomas, Proc. Zool. Soc. London, 1911, p. 144).

† The peculiar distribution suggests the possibility that the animal's presence in Italy is due to artificial introduction.

naked, its surface almost entirely occupied by three tubercular masses, separated by narrow furrows ; anterior pad at bases of digits obscurely trilobed ; posterior pads roundish, the outer larger than the inner. Hind foot much like fore foot, but median claws shorter and hallux better developed than thumb, its claw differing from those of other digits in its smaller size only ; transverse groove separating trilobed tubercular mass at base of digits from posterior mass less distinct than in front foot ; posterior mass single, its anterior border showing a tendency to bilobation. Tail very short, completely hidden in the mass of quills which arise from it. Head, neck, shoulders, limbs and underparts covered with coarse grooved bristles, ranging in length from 20 to 45 mm., their width usually about 2 mm., though those on head are more slender and hair-like, and those along median line from between eyes to shoulders are greatly elongated, attaining a length of 300 mm. and producing a conspicuous erectile crest or mane ; posterior half of back and sides thickly beset with terete quills, ranging in length from 35 to 300 mm., the longest on or near median line, the extremities for the most part stiff and awl-like, but occasionally drawn out into a hair-like filament ; base of tail with stiff terete quills like those of body ; tip bearing a cluster of about a dozen highly modified quills with slender thread-like bases (about 20 mm.) and a hollow terminal portion 20 to 30 mm. long, the hollow part compressed at its base but becoming terete distally ; whiskers stiff and long, extending to shoulders when laid back ; throughout the body there is a sparse growth of coarse hairs among the spines and quills, these hairs most numerous and longest on posterior half of back, where they reach a length of 100 to 150 mm.

Colour.—Underparts, sides and legs blackish brown, the bristles becoming horn-colour at base ; head, neck and shoulders drab, many of the bristles in mane white or whitish ; whiskers black ; quills on back, sides and tail blackish horn-colour, with whitish terminal area 50 to 80 mm. long, and one to three whitish annulations, each about 10 mm. in length, the general effect of the quilled region black conspicuously spotted and streaked with white.

Skull.—In general appearance the skull differs strikingly from that of other European rodents in the great depth and width of the facial portion (post-lachrymal width about equal to depth through same region, and fully one-half basilar length ; occipital depth only about two-thirds that at middle of palate), the unusual area occupied by the nasal bones (posterior margin of nasals near glenoid level ; greatest combined breadth of nasals, in lachrymal region, half or two-thirds their length, and nearly equal to depth at front of tooth-rows), and the very slender, weak anterior extremity of rostrum. Dorsal profile evenly convex from front of nasals to about their posterior

border, then sloping abruptly downward to the relatively low, squarely truncate occipital region. Ventral profile not parallel with dorsal profile, scarcely curved. Brain-case not differen-

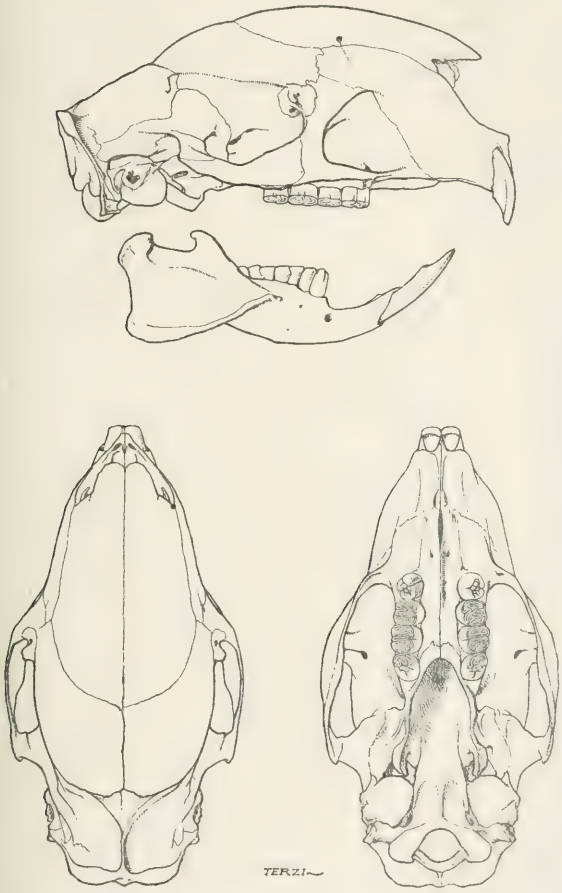

FIG. 107.
Hystrix cristata. × ½.

tiated as an evident region, its width greater anteriorly than posteriorly, the entire surface of each parietal occupied by a deep depression for muscular attachment, the posterior margins

of the depressions forming a distinct lambdoid crest, their inner borders uniting to form a short sagittal ridge. Occipital region almost squarely truncate, though sloping a little forward so that the condyles are just visible when skull is viewed from above (unless hidden by unusual development of lambdoid crest), its outline forming a broad arch about four-fifths as high as wide, slightly flattened at the sides and above, the lower outer extremities of the arch formed by the prominent, triangular, slightly in-curved paroccipital processes, the points of which descend nearly to level of lower surface of condyles. Foramen magnum wider than high. Floor of brain-case without special peculiarities; a slightly developed median longitudinal ridge; auditory bulla rather small, globular, the inflated portion longer than wide, noticeably broader anteriorly than posteriorly, the meatus with a short though evident tube; anterior border in contact with hamular; posterior border free from paroccipital process. Interorbital region, the broadest portion of skull, highly arched laterally, without evident ridges or depressions. Zygoma short and heavy, not widely spreading, its anterior portion deep, the posterior portion shallow, the lower border nowhere above alveolar level though sloping evidently upward behind; anteorbital foramen considerably more than half as large as the rather contracted orbit, its lower wall appearing as a conspicuous anterior prolongation of zygoma. Nasals very large, their widest region slightly behind level of posterior termination of nasal branches of premaxillaries, their extension behind this region at least equal to their anterior extension in front of anteorbital foramina, the posterior outline of the two bones together evenly rounded, their outer borders gradually converging anteriorly to a width a little more than half greatest width; anterior border of each nasal strongly oblique with a slight but evident emargination at outer edge. Nares somewhat narrowly cordate in outline, the apex projecting as a flat shelf or shallow trough over space between shafts of incisors. Facial portion of maxillary terminating posteriorly in line with posterior termination of premaxillary and with middle of lachrymal. Palate narrow, without special features, its width scarcely exceeding alveolar width of cheek-teeth, the portion formed by palatine bones relatively small; incisive foramina small (length about 6 mm.), narrow, slightly divergent posteriorly, nearer to incisors than to cheek-teeth, their outer margins continuous with ridges which pass backward to anterior borders of alveoli of premolars and unite anteriorly to form a noticeable crest between foramina and incisors; septum dividing foramina continued backward as a high median ridge flattening out rather abruptly at level of front of premolar. Mesopterygoid space considerably more than half as wide as long, narrowing rapidly forward from a little behind m^3, the evenly concave anterior border at level of front of m^3; hamular short, obliquely expanded, the posterior, longer limb of

the expansion broadly in contact with inner portion of anterior border of bulla. Mandible relatively slender, the posterior portion not conspicuously deeper than ramus, including cheek-tooth, the anterior portion a mere shell enclosing the robust incisor; articular process broad and low; coronoid process small, not rising conspicuously above level of posterior alveolar border, widely separated from articular process; angular portion broad, lying conspicuously on outer surface of alveolus of incisor, its posterior border slightly concave. Dental foramen at alveolar level.

Teeth.—Incisors robust, without special peculiarities of form, the shafts scarcely compressed, but with antero-posterior diameter perceptibly greater than lateral diameter; enamel surface yellow. Upper incisor with root extending to immediately in front of alveolus of premolar, where its position is indicated by a slight elevation on the surface of the bone; anterior face of tooth slightly oblique, nearly flat though a little rounded off at edges; posterior surface narrow, rounded, so that the outline of cross-section is nearly an isosceles triangle with all the angles rounded. Lower incisor much longer and less curved than upper, its root extending almost to base of articular surface but not producing any very noticeable swelling on outer side of mandible, and scarcely rising above level of molar crowns; anterior face of tooth very oblique, scarcely marked off from posterior face; inner face flat. Cheek-teeth flat crowned, rather large, not showing any very noticeable contrasts of size or structure among themselves. Roots very imperfectly developed, smallest in the upper teeth where they appear as mere irregular tubercles, three of which can usually be distinguished, and sometimes a fourth; shafts higher than wide, slightly tapering downward. Crowns of upper cheek-teeth broadly elliptical in outline, distinctly longer than wide. Their enamel pattern shows individual irregularities, but its scheme is as follows: outer side of crown with three re-entrant folds, the anterior and posterior of which soon become isolated as narrow islands, the middle fold more persistent and often confluent with re-entrant fold of inner side; first and second folds simple; third curving backward and outward, its extremity often becoming isolated as one or two minute secondary islands; lingual side of tooth with a single re-entrant fold usually directed obliquely forward and often communicating with second or more rarely with first outer fold. Pattern of premolar like that of

FIG. 108.

Hystrix cristata. Teeth. × 1½.

CRANIAL MEASUREMENTS OF *HYSTRIX CRISTATA*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Post-lachrymal breadth.	Occipital breadth.	Occipital depth.	Depth at middle of alveolus of m1.	Nasal.	Greatest breadth of both nasals together.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
Italy: Rome . .	97. 2. 22. 1		135·4	72·2	53·8	47·2	35·4	51·0	79·4	43·0	41·2		32·8	—	Premolar not worn.
Vizzini, Sicily .	3. 4. 21. 1		126·0	68·0	53·4	45·6	32·4	51·2	74·0	43·4	36·2	85·6	31·6	20·4	,, slightly worn.
no exact locality	1797 Stockholm		138·2	76·2	59·8	43·2	37·2	57·0	77·2	46·8	45·2	97·6	29·8	33·6	Milk *pm* in place.
No exact locality .	49348		130·0	71·6	58·8	48·8	35·2	53·4	77·6	49·4	36·4	90·8	31·8	33·4	Premolar slightly worn.

molars but showing more tendency to irregularities. Lower teeth with the same pattern reversed, the outer side with one simple, oblique, backward sloping fold, the inner side with three folds, the posterior and middle of which are usually simple, the anterior complex and tending eventually to become divided into two or three irregularly shaped islands arranged somewhat in a spiral. The premolar shows the same tendency as the corresponding upper tooth to become irregular in details of enamel pattern, though the fundamental plan of its folds appears to be always the same as in the molars.

Measurements.—Young adult (probably female) from Vizzini, Sicily (approximate): head and body, 600; tail, 40; hind foot, 75. Immature individual from Province of Rome, Italy (approximate): head and body, 600; tail, 50; hind foot, 85. For cranial measurements see Table opposite.

Specimens examined.—Seven, from the following localities:—
Italy: Near Rome, 4 (B.M. and U.S.N.M.); Vizzini, Sicily, 2; no exact locality, 1 (Stockholm).

3.	Rome, Italy.	Genoa Museum (E).	97. 2. 22. 1–3.
2, juv.	Vizzini, Sicily.	J. I. S. Whitaker (P).	3. 4. 21. 1–2.

Family MUSCARDINIDÆ.

1821. *Myoxidæ* (misprinted *Myosidæ*) Gray, London Med. Repos., xv, p. 303. April 1, 1821.
1857. *Myoxina* Blasius, Säugethiere Deutschlands, p. 285.
1898. *Gliridæ* Lydekker, Zool. Rec. xxxiv. (1897), Mamm. p. 27, 1898. Not of Ogilby, 1837.
1899. *Muscardinidæ* Palmer, Science, N.S., x, p. 413, September 22, 1899.

Geographical distribution.—Warmer portions of the Old World from Japan to England and from central Sweden south through Africa. Absent from Madagascar, the Malay Archipelego and Australia.

Characters.—In general as in the *Muridæ* (p. 591) but cæcum absent, jugal bone larger and forming a more important mechanical part of zygoma (in some genera approaching the condition characteriatic of the *Sciuridæ*), angular process of mandible bent outward at middle so that its lower border bears a noticeable secondary angle, and cheek-teeth always rooted, brachyodont, their crowns with transverse cross ridges variously arranged and sometimes obsolete, but referable to a primitive 3-ridged pattern; one premolar typically present in each jaw.

Remarks.—Six genera of *Muscardinidæ* are currently recognized, four of which occur in Europe. They are mostly arboreal animals with habits and aspect somewhat intermediate between mice and squirrels, but readily distinguishable from the *Muridæ*

by the presence of premolars, the cross-ridged pattern of the enamel folding of the cheek-teeth and the peculiar secondary angulation of the angular process of the lower jaw.

KEY TO THE EUROPEAN GENERA OF *MUSCARDINIDÆ*.

Outer margin of first and second upper molar with two high cusps (occasionally one or two others low and obsolete).
- Crowns of cheek-teeth deeply concave; premolar both above and below noticeably cuspidate; tail not uniformly haired, the basal half terete, the terminal portion slightly flattened *Eliomys*, p. 550.
- Crowns of cheek-teeth slightly concave; premolar both above and below not noticeably cuspidate; tail uniformly haired, moderately distichous... *Dyromys*, p. 566.

Outer margin of crown of first and second upper molar with five or six low cusps.
- Crowns of cheek-teeth very slightly concave; first and second upper molars essentially alike in form and in arrangement of cross-ridges; tail conspicuously distichous ..... *Glis*, p. 572.
- Crowns of cheek-teeth flat; first and second upper molars conspicuously unlike in form and in arrangement of cross-ridges; tail not evidently distichous ..... *Muscardinus*, p. 583.

Genus **ELIOMYS** Wagner.

1843. *Eliomys* Wagner, Abhandl. k. Bayer, Akad. Wissensch. München, Math.-Phys. Cl., III, p. 176 (Sub-genus of *Myoxus*).

1857. *Eliomys* Blasius, Säugethiere Deutschlands, p. 289 (Sub-genus of *Myoxus*) part.

1890. *Eliomys* Reuvens, Die Myoxidae oder Schlaefer, p. 22 (Sub-genus of *Myoxus*) part.

Type species.—*Eliomys melanurus* Wagner.

Geographical distribution.—Europe from the Atlantic coast eastward into Asia Minor, and from northern Germany (Mecklenburg) south into northern Africa.

Characters.—Skull deep, smooth and rounded, without evident ridges or depressions in interorbital region; brain-case deep, the auditory bullæ large; ectopterygoid well developed; jugal short anteriorly, not approaching lachrymal; mandible with angular portion fenestrate; dental formula: $i\frac{1}{1}$, $pm\frac{1}{1}$, $m\frac{3}{3}$ = 20; crowns of cheek-teeth deeply concave laterally, the inner and outer margins noticeably elevated, the outer margin of each maxillary tooth with two high cusps (one or two others low and inconspicuous sometimes present); crown of m^1 and m^2 with five transverse ridges, of which the third is incomplete; tail not uniformly haired throughout, the basal half terete, the terminal portion slightly flattened.

Remarks.—The genus *Eliomys* as now understood contains

about a dozen forms peculiar to the Mediterranean and neighbouring regions. Five of them occur in Europe.

KEY TO THE EUROPEAN FORMS OF *ELIOMYS*.

Size large, hind foot often more than 30 mm., condylobasal length of skull in adults 36 to 39 mm. (Southern Spain and Portugal) ..... *E. lusitanicus*, p. 560.
Size medium, hind foot never more than 30 mm., condylobasal length of skull in adults less than 36 mm.
Underside of tail normally* white from base to tip.
Ear from meatus in adults 23 mm. or more (Central and south-western Europe) ..... *E. quercinus*, p. 551.
Ear from meatus in adults 20 to 22 mm. (Balearic Islands) ..... *E. gymnesicus*, p. 558.
Underside of tail normally† with white interrupted by a black sub-terminal ring.
Condylobasal length of adult skulls 33 to 35·6 mm.; brain-case slightly flattened, the ratio of depth through bulla to condylobasal length about 37·5 (Sicily and southern Italy) ..... *E. pallidus*, p. 559.
Condylobasal length of adult skulls 30 to 32 mm.; brain-case deep, the ratio of depth through bulla to condylobasal length about 42 (Corsica and Sardinia) ..... *E. sardus*, p. 560.

ELIOMYS QUERCINUS Linnæus.

1766. [*Mus*] *quercinus* Linnæus, Syst. Nat., I, 12th ed., p. 84. Germany.
1778. *Mus nitedula* Pallas, Nov. Sp. Quadr. Glir. Ord., p. 88 (part; synonymy, not description).
1782. *Myoxus nitela* Schreber, Säugthiere, pl. CCXXVI (text, IV, p. 833, 1787). Germany.
1857. *Myoxus quercinus* Blasius, Säugethiere Deutschlands, p. 289.
1890. *Eliomys quercinus* Reuvens, Die Myoxidae oder Schlaefer, p. 26.
1904. *Eliomys hortualis* Cabrera, Bol. Real Soc. Españ. Hist. Nat., IV, p. 183, April, 1904 (Valencia, Spain). Type in Madrid Museum.
1907. *Eliomys hamiltonii* Cabrera, Bol. Real Soc. Españ. Hist. Nat. VII, p. 225 (June–July), issued October, 1907. (El Pardo, near Madrid, Spain.) Type in Cabrera collection.
1908. *Eliomys quercinus* Cabrera, Ann. and Mag. Nat. Hist. 8th ser., I, p. 192, February, 1908 (*hortualis* and *hamiltonii* united with *quercinus*).
1910. *Eliomys quercinus* Trouessart, Faune Mamm. d'Europe, p. 136.

Type locality.—Germany.

Geographical distribution.—Central Europe from northern Germany (Mecklenburg) to central Spain (Valencia) and northern Italy; west to the Atlantic coast.

Diagnosis.—Size medium (condylobasal length of largest skulls rarely attaining 33 mm.; hind foot usually 25 to 27 mm.);

* Three partial exceptions among 75 specimens.
† Two exceptions among 34 specimens.

ear large, its height from meatus usually about 23 to 25 mm.; under side of tail white throughout.

External characters.—General form slender, the head rather large, not much elongated, the tail about as long as body without head. Muzzle bluntly conical; the nostrils near together, separated by a deep groove which continues downward to lip; eye rather large and prominent; ear large, extending nearly half-way from eye to muzzle when laid forward, its general outline a simple rather narrow oval, its inner and outer surfaces covered with a fine velvety pubescence; a low inconspicuous ridge extending inward above meatus, its outer extremity not forming angle on margin of conch; front foot with four digits, the two median equal and longest, the inner and outer sub-equal and extending about to second phalanx of median; palm naked, the palmar tubercles five, three of which are sub-equal and closely crowded at bases of phalanges, and two larger at internal and postero-external edge of palm, the internal tubercle with projecting semi-detached extremity representing last vestige of thumb; hind foot with five digits, the thumb abruptly shorter than the others and extending barely to end of first phalanx of second digit; fourth longest, third and second successively a little shorter, fifth extending to middle of second phalanx of fourth; sole rather narrow, naked except at heel, the six tubercles well developed but less crowded than those on palm, the postero-inner much elongated and conspicuously different from others in form, their surface smooth, the region between them noticeably papillose; claws well developed, small, those of fore foot slightly exceeded in size by those of hind foot, except by that of thumb, which is decidedly smaller than the others; tail rather thick, the skin readily breaking and slipping off from the vertebræ, after which the stump partly regenerates and puts forth a dense brush of long hairs;* hairs of tail completely concealing the annulations, their length about 5 mm. at median terete portion of tail, increasing to about 20 mm. at slightly flattened terminal portion. Mammæ: $p\,1 - 1$; $a\,1 - 1$; $i\,2 - 2 = 8$.

Colour.—Upper parts light grey, the back, middle of neck and whole of crown strongly tinged with russet, the sides clearer grey. In some specimens the grey predominates throughout the dorsal region, while in others the russet is in excess; sides ranging from ecru-drab to smoke-grey, usually forming a slight but evident contrast with back. Underparts and inner surface of legs dull creamy or buffy white, irregularly darkened by the slate-colour bases of the hairs. The white covers cheek almost to lower eyelid. Face with conspicuous black area beginning at roots of whiskers, surrounding eye and extending to beneath and slightly behind ear, the posterior portion becoming decidedly broader; a small but noticeable white spot immediately in front

* *See* Thomas, Proc. Zool. Soc. London, 1905, II, p. 491.

of meatus, this succeeded by a larger black spot just above base of upper margin of conch. Ear dusky, sometimes inclining to blackish along anterior border. Muzzle and sometimes face and crown tinged with buffy clay-colour. Feet white, this colour extending over entire wrist and most of forearm, the outer side of upper arm with a longitudinal dusky, sometimes almost blackish streak extending upward to fade into general body colour. Tail sharply bicolor, the under surface white throughout, the upper surface like back through basal half, then darkening abruptly to clear black, this giving way in the pencil to white. Young with back and sides an obscure slaty drab, the russet gradually appearing on back, though often not until after the general colour has assumed the light smoky grey of the adult pelage.

Skull.—The general form of the skull is deep and rather

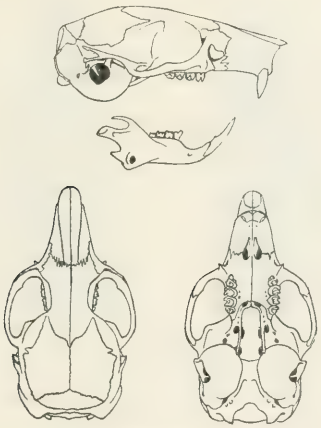

FIG. 109.

Eliomys quercinus. Nat. size.
(The incisive foramina are too short.)

broad posteriorly, tapering noticeably to the slender rostrum. Dorsal profile nearly flat from front of nasals to posterior extremity of frontal or a little beyond, then uniformly and rather strongly convex to interparietal across which it is again flat; ventral profile parallel with dorsal to front of tooth-row then bent down to lowest region of bulla (which lies decidedly below line of pterygoids), behind which it rises abruptly; brain-case squarish in outline when viewed from above, somewhat wider and deeper anteriorly than posteriorly, its surface smooth and without ridges other than a slight angularity along anterior

portion of suture between squamosal and parietal in old individuals, and occasionally a low, backward-projecting lambdal ridge; parietals abruptly bent downward at sides, giving the upper surface of brain-case a peculiar narrowed appearance; interparietal somewhat variable in form, but usually ligulate, with pointed, rounded or squarish extremities and slightly projecting median anterior angle, the antero-posterior diameter from one-third to one-half transverse diameter; auditory bullæ forming a very conspicuous feature of brain-case when viewed from behind, their area decidedly greater than that of occipital, the depth through bulla about equal to distance between outer borders of paroccipital processes; foramen magnum rather large, broader than high, its inferior lip about on level with tips of paroccipital processes; floor of brain-case without special features, the suture between basioccipital and basisphenoid remaining open until late in life; auditory bullæ large, smoothly inflated, the area of each bulla somewhat greater than that of space enclosed between zygoma and side of skull, the anterior border extending forward to level of middle of glenoid fossa, the posterior border solidly moulded against paroccipital process and extending upward along side of exoccipital considerably above level of zygoma, so that this portion of bulla is plainly visible when skull is viewed from above; meatus large, not tubular, but with conspicuous, forward-curved lip in region nearest zygoma; interorbital region slightly hour-glass shaped, the upper surface flat or a little convex laterally, the edges behind middle becoming somewhat angular in old individuals; zygomata rather weak, compressed, a little expanded at middle, gradually spreading anteriorly, the greatest breadth nearly at glenoid level, the lower border essentially straight though sometimes a little concave; anteorbital foramen rather large, considerably higher than wide, its greatest width above middle; rostrum almost parallel-sided when viewed from the side, slightly tapering when viewed from above; nasals a little narrower posteriorly than anteriorly, the posterior border straight or emarginate, rarely pointed, usually about on level with posterior termination of nasal branches of premaxillaries and with middle of lachrymal; incisive foramina large, narrow and parallel-sided anteriorly, becoming abruptly much wider through posterior half or two-thirds, the greatest width of both together slightly more than half length, the length fully equal to one-half diastema;* a noticeable curved ridge extending from posterior border of each incisive foramen to front of alveolus of corresponding premolar; palate wider anteriorly than posteriorly, the small portion formed by the palatine bones conspicuously fenestrate; mesopterygoid space nearly parallel-sided, slightly wider posteriorly than anteriorly, the least width about one-third length, the anterior border rounded, with or without a small

* Not long enough in fig. 109.

median spine, the slightly curved hamular in contact with auditory bulla at tip. External pterygoid plate evident though small, forming a distinct pterygoid fossa. Mandible slender, the ramus curved in front of tooth-row, coronoid process long, sloping gradually backward, its point considerably above level of condyle; angular process well developed, short and deep, the middle of lower border with abrupt angle, above which the bone is perforated by a conspicuous round vacuity about 1·5 mm. in diameter.

Teeth.—The teeth are moderately large relatively to size of skull, the length of tooth-row contained about $2\frac{1}{2}$ times in palatal length; tooth-rows wider apart anteriorly than posteriorly, the alveolar length equal to distance between anterior roots of premolars. Incisors with no special peculiarities, the anterior

FIG. 110.
Eliomys quercinus. Cheek-teeth. × 10.

surface smooth, light yellow, its diameter slightly less than antero-posterior diameter, the discrepancy slightly greater in the lower than in the upper teeth. Root of lower incisor extending to that of m_3; dental foramen at level of alveolar line. Upper cheek-teeth with crowns deeply concave, the inner and outer borders noticeably elevated. Molars sub-equal, the second slightly the largest, the crowns squarish, slightly wider than long, the inner border a little rounded, the posterior border of m^3 shortened; inner border of crown with a robust, moderately high cusp, the most elevated portion of which is in front of middle, its base occupying nearly entire inner border, but in some specimens succeeded by a minute postero-internal cusp early disappearing with wear; outer border with two moderately large subterete cusps, the second not so large as first (the discrepancy greater in m^3 than in the other teeth) and two or

three minute secondary cusps, one in front of first main cusp, the others behind second : surface of crown crossed by four complete transverse ridges, the first, second and third extending from large inner cusp respectively to small anterior cusp, to large anterior cusp and to large posterior cusp, the fourth from small postero-internal to small postero-external; on outer half of crown between the second and third complete cross-ridges occur two incomplete ridges extending inward for a varying distance from posterior base of anterior large cusp and anterior base of posterior large cusp, the outer extremity of one or the other sometimes forming a minute supplemental cusp : in m^3 the third complete ridge is relatively smaller and second incomplete ridge relatively larger than in the other teeth, the first incomplete ridge obsolete or absent. Upper premolar essentially like molars in arrangement of main cusps and ridges, but crown slightly smaller than that of m^1, and somewhat distorted by the more central, anterior position of antero-external root, and ridges tending to be incomplete, especially the two anterior ; secondary ridges and cusps essentially absent ; milk tooth much smaller than permanent premolar, its nearly triangular crown with area barely half that of m^1, its ridges less regular. The milk tooth remains in place until m^3 is fully grown. Lower cheek-teeth much like upper, but with crowns slightly less concave than those of maxillary teeth, and tending, especially that of m_3, to become basin-shaped, their cusps and ridges less sharply defined, those of m_3 often very irregular : outer side of crown with three low but well defined cusps, inner side irregularly crenulate in m_2 and m_3, with two rather low but well defined cusps in m_1, the posterior of which is decidedly the larger ; main cross ridges four, the first and second tending to be distorted and incomplete ; an incomplete intermediate ridge on inner side of crown between second and third main ridges. Lower premolar triangular in outline, its apex in front, its crown area about four-fifths that of m_1 ; a well developed cusp at each corner and an indistinct transverse ridge across middle ; milk tooth smaller than permanent tooth, but discrepancy in size less than in the corresponding upper teeth ; crown of milk premolar essentially like that of succeeding tooth, but with a small cusp at middle of antero-external border, and transverse ridge absent.

Measurements—Two adult females from Maredsous, Namur, Belgium : head and body, 136 and 137 ; tail, 116 and 121 ; hind foot, 28 and 29 ; ear from meatus, 24 and 24. Adult male from l'Hospitalet, Ariège, France : head and body, 116 ; tail, 97·6 ; hind foot, 25·4 ; ear from meatus, 25. Two adult females from the same locality : head and body, 118 and 127 ; tail, 108 and 111 ; hind foot, 26 and 26·4 ; ear from meatus, 24 and 25. Five adult males from Valescure, Var, France : head and body, 125 (115–131) ; tail, 107 (100–111) ; hind foot, 26·3 (25–27) ; ear from meatus, 23·6 (22–25). Five adult females from Silos,

Burgos, Spain: head and body, 120 (115–130); tail, 107 (100–112); hind foot, 26 (25·4–26·6); ear from meatus, 23·4 (22·6–24). Two males from Dehesa de Valencia, Valencia, Spain: head and body, 120 and 125; tail, 100 and 107; hind foot, 26 and 26; ear from meatus, 24 and 24. For cranial measurements see Table, p. 562.

Specimens examined.—One hundred and twenty, from the following localities:—

BELGIUM: Maredsous, Namur, 2.

FRANCE: Pas-de-Calais, 2; l'Hospitalet, Ariège, 7; Porté, Pyrénées-Orientales, 2; Nîmes, Gard, 14 (B.M. and Mottaz); Valescure, Var, 8; Chamonix, Haute-Savoie 3 (U.S.N.M.); Mounetier, Haute-Savoie, 1 (Mottaz); no exact locality, 2.

SPAIN: Cabañas, Coruña, 2; Jaca, Huesca, 4; Panticosa, Huesca, 1; Lérida, 1; Pajáres, Leon, 7; Silos, Burgos, 11; Castrillo de la Reina, Burgos, 1; La Granja, Segovia, 4; Villalba, Madrid, 2; Rascafria, Madrid, 1; Barracas, Castellon, 5; Dehesa de Valencia, 3.

GERMANY: Schmilka, Saxony, 1; Rudolstadt, Thüringen, 2; Marxheim, Bavaria, 1; South Germany, 2.

AUSTRIA-HUNGARY: Spalato, Dalmatia, 1; Mittelberg, Vorarlberg, 2.

SWITZERLAND: Near the Dôle, Vaud, 3 (Mottaz); St. Cergues, Vaud, 2 (B.M. and U.S.N.M.); Les Pians, Vaud, 3 (U.S.N.M.); Mürren, Bern, 1; St. Gallen, 1 (Mottaz); Untervatz, Grisons, 9 (U.S.N.M.); Vulpera-Tarasp, Grisons, 2 (Rothschild); Fusio, Ticino, 1 (U.S.N.M.); no exact locality, 1.

ITALY: Padola, Cadore. 1 (Turin); Mondovi, Cuneo, 4 (Genoa).

2 ♀.	Maredsous, Namur, Belgium.	Rev. G. Fournier (C & P).	3. 3. 30. 1-2.
2 ♀.	Boulogne, Pas-de-Calais, France.	C. G. Danford (C & P).	89. 10. 6. 2. 10. 7. 17. 1.
4 ♀.	L'Hospitalet, Ariège.	G. S. Miller (C).	8. 8. 4. 172–175.
2 ♂, ♀.	L'Hospitalet, Ariège. (*A. Robert.*)	O. Thomas (P).	8. 9. 1. 72–74.
♀.	Porté, Pyrénées-Orientales. (*A. Robert.*)	O. Thomas (P).	8. 9. 1. 75.
♀.	Porté, Pyrénées-Orientales.	G. S. Miller (C).	8. 8. 4. 171.
2 ♂, 4 ♀.	Nîmes, Gard. (*C. Mottaz.*)	O. Thomas (P).	8. 8. 10. 57–62.
5 ♂, 2 ♀.	Valescure, Var.	G. S. Miller (C).	8. 8. 4. 176–182.
♀.	Valescure, Var.	Hon. N. C. Rothschild (C & P).	10. 6. 13. 1.
1.	France.	Dr. J. E. Gray (P).	43. 12. 29. 17.
♂.	France.	Tomes Collection.	7. 1. 1. 76.
♀ al.	Cabañas, Coruña, Spain.	Prof. V. L. Seoane (C & P).	94. 1. 1. 9.
1.	Cabañas, Coruña.	Prof. V. L. Seoane (C & P).	94. 3. 12. 2.
2 ♂.	Jaca, Huesca. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 75–76.
♂.	Panticosa, Huesca. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 77.
♂.	Lérida. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 80.
2 ♀.	Pajáres, Leon. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 78–79.
2 ♂, 3 ♀.	Pajáres, Leon. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 81–85.

8 ♀.	Silos, Burgos.	G. S. Miller (c).	8. 8. 4. 57–64.
♀.	Castrillo, Burgos.	G. S. Miller (c).	8. 8. 4. 65.
2 ♀.	Villalba, Madrid. (*N. Gonzalez.*)	O. Thomas (p).	8. 2. 9. 70–71.
♂, 3 al.	La Granja, Segovia.	M. de la Escalera (c).	6. 11. 4. 5–8.
3 ♂.	Barracas, Castellon. (*N. Gonzalez.*)	O. Thomas (p).	8. 2. 9. 72–74.
3 ♂.	Dehesa de Valencia. (*N. Gonzalez.*)	O. Thomas (p).	8. 2. 9. 67–69.
♂, ♀.	Rudolstadt, Thüringen, Germany. (*W. Schäller.*)	Lord Lilford (p).	0. 5. 5. 1–2.
♂.	Marxheim, Bavaria. (*Wolterstorff.*)	Lord Lilford (p).	0. 5. 5. 3.
2.	S. Germany.	Dr. A. Günther (c).	59. 9. 6. 25–26.
1.	Spalato, Dalmatia.	Lord Lilford (p).	95. 4. 6. 1.
2 ♀.	Mittelberg, Austria. (*Dr. F. Major.*)	O. Thomas (p).	8. 11. 30. 5–6.
♀.	St. Cergues, Vaud, Switzerland.	C. Mottaz (p).	6. 2. 6. 5.
1.	Mürren, Bern.	W. Gürtner (p).	92. 10. 5. 6.
1.	Switzerland.	E. R. Alston (p).	79. 9. 12. 3.

ELIOMYS GYMNESICUS Thomas.

1901. *Eliomys quercinus* Thomas, Proc. Zool. Soc., London, p. 41.
1903. *Eliomys gymnesicus* Thomas, Ann. and Mag. Nat. Hist., 7th ser., XI, p. 494, May, 1903. Type in British Museum.
1910. *Eliomys quercinus gymnesicus* Trouessart, Faune Mamm. d'Europe, p. 137.

Type locality. San Cristobal, Minorca, Balearic Islands.

Geographical distribution.—Balearic Islands.

Diagnosis.—Similar to *Eliomys quercinus* but with smaller ear (height from meatus 20 to 22 mm. instead of 23 to 25 mm.).

Colour.—The colour is in all respects like that of *Eliomys quercinus*, though the upper parts appear to be a little more suffused with reddish brown than usual in the mainland animal. Tail markings exactly as in *E. quercinus*.

Measurements.—Type (adult male): head and body, 131; tail, 107; hind foot, 26; ear from meatus, 21. Two other adult males from the type locality: head and body, 116 and 120; tail, 100 and 102; hind foot, 27 and 25·5; ear from meatus, 22 and 20. For cranial measurements see Table, p. 564.

Specimens examined.—Six, all from the Island of Minorca.

Remarks. The Balearic *Eliomys* appears to be well differentiated from the mainland animal by its smaller ear.

5 ♂, ♂ skull.	San Cristobal, Minorca.	O. Thomas and R. I. Pocock (c & p).	0. 7. 1. 44–49. (0. 7. 1. 47. *Type* of species.)

ELIOMYS PALLIDUS Barrett-Hamilton.

1899. *Eliomys pallidus* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., III, p. 226, March, 1899. Type in British Museum.

1901. *Eliomys cincticauda* Miller, Proc. Biol. Soc., Washington, XIV, p. 39, April 25, 1901. (Sorrento Italy). Type in U.S. National Museum.

1910. *Eliomys cincticauda* and *E. pallidus* Trouessart, Faune Mamm. d'Europe, pp. 137, 138.

Type locality.—Palermo, Sicily.

Geographical distribution.—Sicily and southern Italy.

Diagnosis.—Size greater than in *Eliomys quercinus* (condylo-basal length of largest skulls usually 33 to 35 mm. ; hind foot usually 27 to 29 mm.) ; general colour not so dark as in the more northern animal ; tail with sub-terminal black area forming a complete ring ; skull with posterior termination of nasals usually pointed.

Measurements.—Average and extremes of ten adult males from Sicily : head and body, 143 (130–150) ; tail, 118 (110–131) ; hind foot, 28·8 (27–30) ; ear from meatus, 23·6 (22–25). Four adult females from the same region : head and body, 142 (136–150) ; tail, 111·4 (105–120) ; hind foot, 27·7 (27–29). Three adult females from Calabria, Italy : head and body, 143 (140–145) ; tail, 130·6 (125–135) ; hind foot, 28·6 (27–30) ; ear from meatus, 22·6 (22–24). For cranial measurements see Table, p. 564.

Specimens examined.—Thirty-four, from the following localities :—

ITALY : Tuscany (no exact locality), 1 (U.S.N.M.) ; Sorrento, 5 ; type and paratypes of *cincticauda* (U.S.N.M.) ; Santa Eufemia d'Aspromonte, Calabria, 9.

SICILY : Palermo, 3 ; Ficuzza, 7 ; San Giuglielmo, Castelbuono, 3 ; Mondello, 2 ; Madonna del Alto, 4.

Remarks.—In general the South Italian *Eliomys* so closely agrees with *E. quercinus* as to require no detailed description. The larger size, readily appreciable in skull, teeth and hind foot, is alone sufficient to distinguish it ; but in addition to this there is the peculiar black-ringed tail, a character nearly always diagnostic as compared with *E. quercinus*, though shared by the much larger Iberian *E. lusitanicus*. In details of form the skull shows no peculiarities other than the tendency of the nasals to terminate posteriorly in a distinct median point. The type specimen is an immature individual in the light transitional pelage between the plumbeous first coat and the russet-tinged livery of the adult.

3 ♂, 6 ♀.	Aspromonte, Calabria, Italy. (*A. Robert.*)	O. Thomas (P).	6. 8. 4. 2–5. 8. 9. 1. 33–35.
♂, ♀.	Palermo, Sicily.	J. I. S. Whitaker (P).	98. 10. 6. 6–7. (98. 10. 6. 6. *Type* of species.)
♀ juv.	Palermo, Sicily.	J. I. S. Whitaker (P).	11. 1. 1. 110.
5 ♂, 1 ♀.	Ficuzza, Sicily. (*A. Robert.*)	O. Thomas (P).	6. 8. 4. 28–32. 8. 9. 1. 32.

2 ♂.	Mondello, 1000 m. Sicily. (*A. Robert.*)	O. Thomas (P).	6. 8. 4. 33-34.
2 ♂, 2 ♀.	Madonna del Alto, Sicily. (*A. Robert.*)	O. Thomas (P).	8. 9. 1. 28-31.

ELIOMYS SARDUS Barrett-Hamilton.

1901. *Eliomys sardus* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., VII, p. 340, April, 1901.

1910. *Eliomys sardus* Trouessart, Faune Mamm. d'Europe, p. 138.

Type locality.—Tricoli, Cagliostra, Sardinia.

Geographical distribution.—Sardinia and Corsica.

Diagnosis.—Similar to *Eliomys pallidus* but with smaller skull (condylobasal length 30 to 32 mm.) and relatively deeper brain-case.

Colour. The colour does not differ appreciably from that of *Eliomys pallidus*.

Skull and teeth.—The skull does not attain the large size of that of *E. pallidus*. In form it is peculiar in the relatively greater depth of brain-case, the ratio of depth through bulla to condylobasal length ranging in four specimens from 41+ to 43+, while in seven of the larger animals it ranges from 37 to 38+. Teeth as in the related form.

Measurements.—Type (old female): hind foot, 26·6. Three other Sardinian specimens: hind foot, 25·4, 26 and 28. For cranial measurements see Table, p. 565.

Specimens examined.—Nine, from the following localities:—
SARDINIA: Tricoli, 2; Lanusei, 2.
CORSICA: Asco, 5.

♂ juv., ♀.	Tricoli, Sardinia. (*G. Meloni.*)	O. Thomas (P). (1. 3. 8. 1. *Type* of species.)	1. 3. 8. 1-2.
♂, ♀.	Lanusei, Sardinia. (*G. Meloni.*)	O. Thomas (P).	1. 3. 8. 3-4.
2 ♂, 2 ♀.	Asco, Corsica. (*Dr. F. Major.*)	O. Thomas (P).	8. 11. 30. 1-4.

ELIOMYS LUSITANICUS Reuvens.

1890. *El[iomys] nitela* var. *lusitanica* Reuvens, Die Myoxidae oder Schlaefer, p. 28, footnote (Lisbon, Portugal).

1897. *Mioxus nitela* var. *amori* Graels, Mem. Real Acad. Sci., Madrid, XVII, p. 481 (Cordova, Spain).

1901. *E[liomys] amori* Thomas, Proc. Zool. Soc., London, p. 41.

1904. *Eliomys amori* Cabrera, Bol. Real Soc. Españ. Hist. Nat., XVII, p. 187, April, 1904.

1908. *Eliomys lusitanicus* Cabrera, Ann. and Mag. Nat. Hist., 8th ser., I, p. 189, February, 1908.

1910. *Eliomys quercinus lusitanicus* Trouessart, Faune Mamm. d'Europe, p. 137.

Type locality.—Lisbon, Portugal.

Geographical distribution.—Southern portion of the Iberian Peninsula; exact limits of range not known.

Diagnosis.—Largest European member of the genus *Eliomys* (hind foot in adults usually more than 30 mm.); skull con-

spicuously larger and heavier than in *E. quercinus*, the condylo-basal length of skull, 36–39 mm.; colour slightly darker and more brighty russet than in *E. quercinus*, the tail usually with black sub-terminal area forming a complete ring.

Colour.—Paratype (No. 46. 11. 21. 1): hairs of back with three distinct colour bands: (1) slate-grey (8 mm.); (2) light buffy grey (2 mm.); (3) russet (2 mm.), the extreme tips of hairs whitish. Longer hairs black except for the slate-grey bases. The general effect is a peculiar dull reddish brown, faintly "lined" by the longer black hairs and a little "powdered" by the whitish tips to the ordinary hairs. On sides the buffy grey band becomes longer (4 mm.) and paler (a clearer, more whitish grey), the russet at the same time gradually disappearing. Dark markings of head as in *E. quercinus*. Tail as in *E. quercinus*, except that the black ring usually present in *E. lusitanicus* is indicated on lower surface by dark bases to the hairs in the region where it should occur.

Specimens from Seville, Spain, resemble the paratype except that the russet of the back is slightly more intense, a difference that might readily be accounted for by their fresher condition, the paratype having been in the Museum collection more than fifty years longer than the others. In five of the Seville skins the black ring on the tail is complete, the black area on under side ranging from 40 mm. to 60 mm. in width. In one, however, as well as in a specimen from Coto Doñana, Province of Huelva, the tail is like that of the paratype, the ring being merely indicated by dark bases to the hairs of the white under surface.

Skull and teeth.—Except for its noticeably larger size the skull resembles that of *Eliomys quercinus*. As in the smaller animal, the nasals are truncate or emarginate posteriorly, not pointed as they usually are in the other ring-tailed species, *E. pallidus* and *E. sardus*. Teeth as in *E. quercinus*, but appreciably larger, the difference more noticeable to the eye than might be supposed from the actual measurements.

Measurements.—Paratype (sex not known) from Lisbon, Portugal: hind foot, 30. Adult male from Coto Doñana, Huelva, Spain: head and body, 166; tail, 120; hind foot, 31; ear from meatus, 27. Three adult males from Seville, Spain: hind foot, 31, 31 and 32. For cranial measurements see Table, p. 565.

Specimens examined.—Twelve, from the following localities:—
PORTUGAL: Lisbon, 1.
SPAIN: Seville, 6; Coto Doñana, Huelva, 3; Jerez, Cadiz, 2.

Remarks.—The South Spanish *Eliomys* is so readily distinguishable from the other ring-tailed species by its large size that no special comparisons are required.

1.	Lisbon, Portugal.	C. Friend (C & P).	46. 11. 21. 1. (*Paratype* of species.)
2 ♂, ♀.	Seville, Spain. (*Dr. A. Ruiz.*)	Lord Lilford (P).	95. 3. 3. 19–21.

CRANIAL MEASUREMENTS OF *ELIOMYS QUERCINUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Mastoid breadth.	Interorbital constriction.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
Belgium: Maredsous	3. 3. 30. 1	♀	33·0	19·0	16·0	5·0	12·0	8·2	18·4	5·0	5·0	Teeth slightly worn.
,,	3. 3. 30. 2	♀	32·6	19·0	16·8	5·2	12·0	7·8	18·2	5·4	5·0	,, ,,
France: l'Hospitalet, Ariège	172137	♂	30·4	19·4	15·6	5·0	11·6	7·2	17·6	5·0	5·0	,, ,,
,, ,,	8. 8. 4. 174	♀	31·0	19·6	15·4	5·0	11·8	7·8	18·0	5·2	5·0	,, ,,
,, ,,	8. 8. 4. 175	♀	31·0	19·4	15·2	5·0	12·0	7·8	17·6	5·0	5·0	,, ,,
,, ,,	152773	♂	32·2	19·0	15·0	4·8	13·2	7·8	18·4	5·0	4·8	,, moderately worn.
Porté, Pyrénées-Orientales	152775	♀	31·0	19·8	15·2	4·6	12·8	8·0	17·8	4·8	5·0	,, much worn.
Nîmes, Gard	8. 8. 10. 61		33·2	21·0	16·2	5·2	13·0	8·2	19·0	5·2	5·0	,, ,,
,, ,,	8. 8. 10. 62		32·0	20·0	16·6	5·0	12·4	7·8	19·6	5·4	5·0	,, ,,
Valescure, Var.	172142	♂	31·2	19·0	15·4	5·2	11·8	7·6	18·0	5·2	4·8	,, slightly worn.
Chamonix, Haute-Savoie	124473	♂	32·8	20·2	15·8	5·2	13·8	7·6	18·6	5·4	5·0	,, ,,
,, ,,	124474	♂	31·4	19·8	15·8	5·0	12·2	8·0	18·0	5·2	4·8	,, much worn.
,, ,,	124475	♀	33 6	—	15·4	5·2	13·6	8·6	19·4	5·4	5·0	,, ,,
Germany: South Germany	59. 9. 6. 26		32·0	19·0	16·6	5·0	11·8	8·0	18·4	4·8	4·8	,, slightly worn.
Rudolstadt, Thüringen	0. 5. 5. 1	♂	30·6	—	15·4	4·8	11·0	7·4	—	4·8	—	,, ,,
,, ,,	0. 5. 5. 2	♂	32·2	19·2	16·2	4·8	11·0	7·8	18·2	5·0	5·0	,, ,,

Austria-Hungary; Spalato, Dalmatia	95. 4. 6. 1		32·6	—	16·4	4·8	13·0	7·8	18·2	6·0	5·4	Teeth not worn.
Switzerland: St. Cergues, Vaud	6. 2. 6. 5	♀	32·2	18·8	16·2	4·8	11·8	8·2	18·6	4·8	4·8	,, slightly worn.
,, ,,	124396	♂	31·2	18·6	15·4	4·6	11·6	7·8	17·6	5·0	4·8	,, ,,
Les Plans . .	104493	♂	32·8	20·8	16·6	5·0	13·0	8·0	18·4	5·2	5·2	,, moderately worn.
,, . .	104494	♀	32·4	20·0	15·8	5·0	13·0	7·8	18·6	5·2	5·0	,, ,,
Neuchatel . .	62245	♂	32·2	19·8	15·6	5·0	12·8	7·8	18 4	5·0	4·8	,, ,,
Untervatz, Grisons	145174	♂	30·0	18·8	14·8	4·8	11·8	7·2	16·6	5·2	5·0	,, ,,
,, ,,	145177	♂	31·0	18·2	14·8	4·8	12±	7·8	17·2	5·4	5·0	,, slightly worn.
,, ,,	145178	♂	30·6	19·8	15·2	4·8	12·2	7·4	17·4	5·4	4·8	,, moderately worn.
,, ,,	145175	♀	30·8	19·2	15·0	4·8	12·2	7·4	17·0	4·8	4·8	,, ,,
,, ,,	145176	♀	30·0	19·0	15·0	4·8	12·2	7·2	17·0	5·4	5·0	,, ,,
Spain: Lérida . . .	8. 2. 9. 80	♂	32·6	20·2	16·8	5·0	13·0	8·0	18·6	5·2	5·0	,, slightly worn.
Panticosa, Huesca .	8. 2. 9. 77	♂	32·0	19·0	15·8	5·0	12·0	8·0	18·0	5·8	5·0	,, ,,
Jaca ,, . .	8. 2. 9. 75	♂	31·4	19·8	16·4	5·4	12·0	7·8	18·0	5·4	5·0	,, moderately worn.
,, ,, . .	8. 2. 9. 76	♂	33·0	20·4	16·4	5·0	13·0	8·0	19·0	5·4	5·0	,, ,,
,, ,, . .	152781	♀	31·0	18·4	15·4	5·0	12·0	7·0	17·8	5·4	5·0	,, ,,
Pajáres, Leon . .	8. 2. 9. 78	♀	31·4	19·8	16·0	5·0	12·0	7·2	18·0	5·0	4·8	,, much worn.
,, ,, . .	8. 2. 9. 79	♀	31·4	—	16·0	5·0	12·0	7·6	18·6	5·2	5·0	,, slightly worn.
Silos, Burgos . .	172139		31·0	19·6	15·8	5·0	12·8	7·2	18·0	5·4	5·0	,, moderately worn.
,, ,, . .	8. 8. 4. 64		30·8	19·6	15·4	5·0	12·0	7·6	17·8	5·0	5·0	,, ,,
Barracas, Castellon .	8. 2. 9. 72	♂	31·0	19·2	15·4	5·0	12·0	7·0	17·4	5·8	5·4	,, slightly worn.
,, ,, .	8. 2. 9. 73	♂	31·0	19·0	15·4	5·0	12·0	7·0	17·8	5·0	5·0	,, ,,
,, ,, .	8. 2. 9. 74	♂	32·0	20·2	15·8	5·0	12·0	7·8	18·0	5·2	5·0	,, ,,
,, ,, .	152780	♂	31·4	20·0	17·2	5·0	12·0	7·6	18·0	5·4	5·0	,, ,,

CRANIAL MEASUREMENTS OF *ELIOMYS GYMNESICUS*, *E. PALLIDUS*, *E. SARDUS* AND *E. LUSITANICUS*.

Locality	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Mastoid breadth.	Interorbital constriction.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
E. gymnesicus.												
Balearic Islands: San Cristobal, Minorca	0.7.1.45*	♂	31·0	18·8	15·0	5·0	11·8	7·6	17·4	5·4	5·4	Teeth moderately worn.
,, ,,	0.7.1.47	♂	31·2	19·8	15·2	4·8	11·8	7·2	18·2	5·6	5·0	,, slightly worn.
,, ,,	0.7.1.49	♂	30·0	19·0	15·2	4·8	10·4	7·0	17·2	5·4	5·2	,, ,,
,, ,,	0.7.1.48	♂	30·6	19·4	15·4	5·0	11·4	6·6	17·0	5·6	5·0	,, ,,
,, ,,	0.7.1.44	♂	30·0	19·0	15·2	4·8	11·0	6·8	17·6	5·6	5·4	,, ,,
,, ,,	0.7.1.46	♂	30±	19·0	15·4	5·0	11·2	6·8	17·8	5·6	5·4	,, ,,
E. pallidus.												
Italy: Sorrento	103030†	♂	31·2	19·0	16·6	4·6	12·4	8·0	18·2	5·4	5·2	,, moderately worn.
,,	103031	♂	33·0	20·8	16·0	4·4	12·4	7·8	19·0	5·8	5·2	,, slightly worn.
,,	103032	♂	33·8	20·8	15·8	4·6	13·2	7·8	19·2	5·8	5·2	,, moderately worn.
Sta Eufemia d'Aspromonte	6.8.4.3	♀	32·4	20·0	15·4	4·4	13·4	7·6	18·0	6·0	5·0	,, slightly worn.
,, ,,	6.8.4.5	♀	32·8	20·0	17·0	4·6	13·0	8·0	18·4	5·4	5·0	,, moderately worn.
,, ,,	8.9.1.35	♀	34·0	—	16·4	5·0	14·0	8·4	19·0	5·6	5·0	,, ,,
,, ,,	152765	♀	34·3	20·6	16·2	5·0	14·0	8·4	19·6	6·0	5·2	,, ,,
Sicily: Palermo	98.10.6.6*	♂	—	—	—	5·0	13·6	8·0	18·6	5·6	5·0	,, not worn.
San Giuglielmo Castelbuono	152769	♂	35·6	22·2	17·2	5·2	14·6	9·0	20·0	5·4	5·0	,, much worn.
,, ,,	152770	♂	34·2	21·2	16·0	5·0	13·4	8·0	19·8	5·8	5·2	,, moderately worn.
,, ,,	152771	♂	34·8	21·8	15·8	5·0	13·8	8·2	19·6	5·8	5·2	,, ,,

Sicily: Ficuzza	6.8.4.28	♂	34·6	22·0	17·0	5·0	13·4	8·2	20·0	5·6	5·0	Teeth slightly worn.
,,	6.8.4.30	♂	33·8	21·0	16·4	5·0	13·0	7·8	19·0	5·4	5·0	,, ,,
,,	6.8.4.31	♂	34·0	21·8	16·8	5·0	13·8	8·2	20·0	5·6	5·0	,, ,,
,,	152768	♂	34·0	22·0	16·2	5·0	13·2	8·0	19·6	5·4	5·0	,, ,,
,,	6.8.4.32	♀	34·0	21·0	16·4	4·6	14·0	8·0	19·2	5·8	5·0	,, moderately worn.
Mondello	6.8.4.33	♂	34·6	22·0	17·0	4·8	14·0	8·4	21·0	5·8	5·0	,, much worn.
,,	6.8.4.34	♂	32·4	20·4	15·4	4·8	13·0	8·0	18·6	5·0	4·8	,, slightly worn.
Madonna del Alto	8.9.1.31	♀	33·6	21·4	16·8	4·8	13·4	8·2	19·2	5·6	5·0	,, moderately worn.
E. sardus.												
Sardinia: Tricoli	1.3.8.1*	♀	32·0	21·0	16·0	5·0	13·0	8·0	18·6	5·0	5·0	,, much worn.
Lanusei	1.3.8.4	♀	30·6	18·8	15·2	4·6	12·4	7·6	18·0	5·0	5·0	,, slightly worn.
Corsica: Asco	8.11.30.3	♀	31±	—	15·6	4·8	12·0	7·2	18·0	5·4	5·2	,, ,,
,,	8.11.30.2	♂	30·4	19·0	16·0	4·4	12·6	7·2	18·0	5·4	5·0	,, ,,
E. lusitanicus.												
Portugal: Lisbon	46.11. 21.1‡		—	—	—	—	13·4	8·0	21·0	6·0	5·6	,, ,,
Spain: Seville	95.3.3.19	♂	38·0	23·0	18·2	5·2	15·4	8·8	22·6	6·6	5·6	,, moderately worn.
,,	95.3.3.20	♂	36·0	22·4	18·0	5·2	14·6	8·8	22·0	6·2	6·0	,, slightly worn.
,,	95.3.3.21	♂	36·2	22·2	17·6	5·0	14·2	8·8	21·4	5·8	5·8	,, ,,
,,	95.3.3.41		39·0	25·0	18·4	5·4	15·6	10·0	22·8	6·2	6·0	,, much worn.
,,	95.3.3.22	♀	36±	23·0	18·0	5·2	13·8	8·6	21·0	6·0	5·8	,, slightly worn.
,,	152767	♀	36·0	22·8	18·0	5·0	14·2	8·6	21·0	6·0	5·4	,, much worn.
Coto Doñana, Huelva	0.5.10.1		—	21·8	—	5·2	14·2	8·6	20·6	5·8	5·6	,, ,,

* Type. † Type of *cincticauda* Miller. ‡ Paratype.

♂ st	Seville. (*Dr. A. Ruiz.*)	Lord Lilford (P).	95. 3. 3. 22.
♂, ♀.	Seville, Spain.	Lord Lilford (P).	11. 1. 1. 108–109.
1.	Coto Doñana, Huelva.	A. Chapman (C & P).	0. 5. 10. 1.
2 ♂.	Jerez, Cadiz.	A. Chapman (C & P).	8. 3. 26. 1–2.

Genus **DYROMYS** Thomas.

1780. *Myoxus* Zimmermann, Geogr. Gesch., II, p. 351 (part).

1857. *Eliomys* Blasius, Säugethiere Deutschlands, p. 288 (Sub-genus of *Myoxus*) part.

1890. *Myoxus* Reuvens, Die Myoxidae oder Schlaefer, p. 24 (Sub-genus of *Myoxus*) part.

1906. *Dryomys* Thomas, Proc. Zool. Soc., London, 1905. II, p. 345, April 5, 1906 (Sub-genus of *Eliomys*). Not of Philippi, An. Mus. Nac. de Chile, XIV, p. 20, 1900.

1907. *Dyromys* Thomas, Ann. and Mag. Nat. Hist., 7th ser., XX, p. 406, November, 1907 (Substitute for *Dryomys*).

Type.—*Mus nitedula* Pallas.

Geographical distribution. From central Asia through Asia Minor to Hungary and eastern Switzerland.

Characters.—Teeth resembling those of *Eliomys* but relatively smaller than in any of the other European members of the family, the crowns with concavity less pronounced than in *Eliomys* and cross-ridges better developed, the first intermediate ridge in the upper molars nearly complete and scarcely lower than the others; three rudimentary ridges intercalated between the main ridges of m_1, m_2 and m_3; outer border of crowns of upper molars with two high main cusps nearly as well developed as in *Eliomys*, these usually supplemented by a minute anterior or posterior cusp; lower molars with outer cusps relatively lower than in *Eliomys* and sub-equal in size, inner cusps essentially as in the related genus; premolars both above and below with crowns sub-quadrate in outline, nearly flat, the cusps obsolete, the maxillary tooth crossed by four or five ridges, the anterior of which are better developed than in *Eliomys*. Skull essentially as in *Eliomys*, but parietals as broad as in *Muscardinus;* the angular process of mandible fenestrate. Externally differing from *Eliomys* in the uniformly haired, distichous tail.

Remarks.—Though nearly related to *Eliomys* this group seems worthy of recognition as a genus. Seven forms are known, four of which (three of them apparently local races of one species) occur in Europe.

KEY TO THE EUROPEAN FORMS OF *DYROMYS*.

Skull broad and robust, the zygomatic breadth about 17 mm.; auditory bullæ decidedly enlarged (Rustschuk, Bulgaria)..... *D. robustus*, p. 572.

Skull slender, the zygomatic breadth about 15 mm.; auditory bullæ not specially enlarged ..... *D. nitedula*, p. 567.

Teeth weak; crown area of upper premolar decidedly more than half that of first molar (Greece) ..... *D. nitedula wingei*, p. 570.
Teeth robust; crown area of upper premolar scarcely half that of first molar.
General colour of adults yellowish brown above (Hungary and eastward) ..... *D. nitedula nitedula*, p. 568.
General colour of adults greyish brown above (Tirol and eastern Alps)..... *D. nitedula intermedius*, p. 569.

DYROMYS NITEDULA Pallas.

(Synonymy under subspecies.)

Geographical distribution.—South-eastern Europe from eastern Switzerland and north-eastern Italy into Asia Minor; north to northern Hungary. Limits of range not known.

Diagnosis.—General characters as in the genus; tail about as long as head and body; face with dark line from muzzle to ear. Skull slender, the rostrum rather long; auditory bullæ not specially enlarged.

External characters.—Externally as in *Eliomys quercinus*, except that tail is uniformly rather long-haired throughout, its form moderately distichous; ear smaller, extending barely to middle of eye when laid forward, the ridge on its inner surface above meatus high and valve-like, terminating externally in a conspicuous angular projection on margin of conch; relative lengths of digits as in *E. quercinus;* fore foot longer and narrower, the terminal lobe of postero-internal tubercle larger and more distinct; hind foot with surface of sole between tubercles less papillose, scarcely more than reticulate, and postero-internal tubercle not much longer than that at base of thumb, though narrower. Mammæ: $p\ 2-2$, $i\ 2-2 = 8$.

Colour.—Upper parts ranging from a light, clear greyish brown to a distinctly yellowish brown with a russet tinge, the face usually paler than back, the tail like rest of dorsal surface, but lighter or more greyish, and sprinkled with whitish hairs at edges. Underparts and feet whitish or very pale buff, this colour usually suffusing under side of tail. A well defined blackish line extends from base of whiskers to ear, including eye (width on upper lid about 1·5 mm., on lower lid about ·5 mm.), and is often rendered more conspicuous by a light edging along upper border.

Skull.—In general appearance the skull resembles that of *Eliomys quercinus*, though in size and certain peculiarities of form it more nearly approaches that of *Muscardinus avellanarius*. It suggests that of *Eliomys quercinus* in form of brain-case (though the parietals are relatively broader), of interorbital region, of rostrum as viewed from above, and in the gradually spreading

zygomata. The form of the auditory bulla is also, as in *Eliomys*, much more inflated anteriorly than posteriorly, and readily distinguishable from the rounder, more evenly inflated bulla of *Glis* and *Muscardinus*.

Teeth.—The detailed structure of the teeth has already been sufficiently described. As compared with those of *Eliomys quercinus* the molar rows are more nearly parallel, and there is

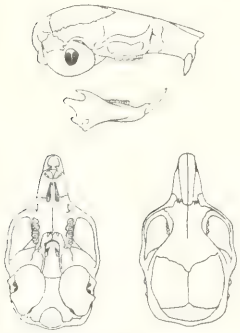

FIG. 111.
Dyromys nitedula. Nat. size.

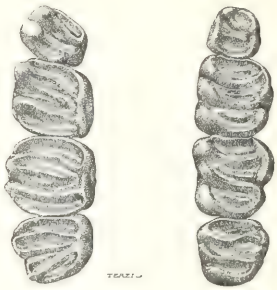

FIG. 112.
Dyromys nitedula. Cheek-teeth. × 10.

usually less contrast in size both above and below between the premolar and last molar with the two middle teeth.

Remarks.—Among the European *Muscardinidæ* this species is immediately recognizable by the combination of a dark face streak and uniformly bushy tail. In size it is intermediate between *Muscardinus avellanarius* and *Eliomys quercinus*, but nearer the former. In different parts of its range *Dyromys nitedula* has become modified into four local races, three of which occur in Europe.

DYROMYS NITEDULA NITEDULA Pallas.

1778. *Mus nitedula* Pallas, Nov. Sp. Quadr. Glir. Ord., p. 88, part, description, not synonymy (Region of the lower Volga, Russia).

1782. *Myoxus dryas* Schreber, Säugthiere, pl. CCXXV B.; description, IV, p. 831, 1787 (Region of the lower Volga, Russia).

1857. *Myoxus dryas* Blasius, Säugethiere Deutschlands, p. 295.

1906. *Eliomys nitedulus* Thomas, Proc. Zool. Soc., London, 1905, II, p. 348, April 5, 1906.

1910. *Dyromys nitedula* Trouessart, Faune Mamm. d'Europe, p. 133.

Type locality.—Region of the lower Volga, Russia.

Geographical distribution.—South-eastern Europe north of the Balkan Peninsula, west to Hungary. Exact limits of distribution not known.

Diagnosis.—Skull with rostrum rather long, the distance from anterior root of zygoma to tip of nasal more than 8 mm.; teeth robust; crown area of upper premolar scarcely half that of first molar; general colour of adults yellowish brown above.

Colour.—Adult: upper parts a yellowish brown intermediate between the russet of Ridgway and yellowish wood-brown, the back inconspicuously "lined" with black, the sides lightening almost to ochraceous-buff; underparts pale cream-buff; tail hair-brown above in noticeable contrast with back, the sprinkling of whitish hairs along edge indistinct, underside of tail mixed whitish and mouse-grey, much darker than belly; feet whitish; muzzle and entire region between black face stripes as far as eyes light grey, this colour continuing to ear as a border to black stripe about 2 mm. wide. An obscurely defined buffy white spot at anterior base of ear. Young similar to adult but duller, the upper parts light wood-brown, sometimes with a greyish tinge.

Measurements.—Hind foot in an adult male from Belgrade, Servia, 21 mm. Hind foot in three specimens from Zubereč, northern Hungary, 20·5, 21 and 21 mm. For cranial measurements see Table, p. 571.

Specimens examined.—Twelve, from the following localities:—
Austria-Hungary: Zubereč, northern Hungary, 6; Herkulesbad, 3; Hungary, no exact locality, 1.
Servia: Belgrade, 2.

4, 1 juv.	Zubereč, Hungary.	Budapest Museum (E).	94. 3. 1. 37–41.
1.	Zubereč.	G. Barrett-Hamilton (P).	11. 1. 2. 59.
2 ♂, 1 ♀.	Herkulesbad. (*F. Cox.*)	Hon. N. C. Rothschild (F).	7. 9. 16. 12–14.
2 ♀.	Belgrade, Servia.	Dr. R. B. Sharpe (F).	75. 8. 24. 3–4.

Dyromys nitedula intermedius Nehring.

1902. *Myoxus intermedius* Nehring, Sitz.-Ber. Gesellsch. Naturforsch. Freunde, Berlin, p. 155.
1910. *Dyromys nitedula intermedius* Trouessart, Faune Mamm. d'Europe, p. 134.

Type locality.—Near Lienz, Tirol, Austria-Hungary.

Geographical distribution.—Tirol and eastern portion of the Alps (Engadine and Cadore).

Diagnosis.—Similar to *Dyromys nitedula nitedula*, but general colour of upper parts greyish brown without tinge of yellow.

Colour.—Upper parts between the broccoli-brown and mouse-grey of Ridgway, a little suffused with wood-brown across thighs and rump; tail slightly darker than back but not different in colour, its edges creamy white in strong contrast; underparts and feet buffy white, this colour suffusing whole underside of tail. Face markings as in true *nitedula*, but grey edging along upper side of black lines less evident.

Measurements.—Two adult males from Vulpera-Tarasp,

Grisons, Switzerland: head and body, 92 and 93; tail, 90 and 70 (imperfect); hind foot, 19·5 and 20·5; ear from meatus, 14·5. Adult from Padola, Cadore, Italy: head and body, 86; tail, 86; hind foot, 19.

Specimens examined.—Four, from the following localities:—
SWITZERLAND: Vulpera-Tarasp, Grisons, 2 (Rothschild).
ITALY: Padola, Cadore, 2 (B.M. and U.S.N.M.).

Remarks.—At first sight this animal might be supposed to be the young of *Dyromys nitedula nitedula*, but none of the three specimens examined shows any indication of immaturity.

1 al.	Cadore, Venetian Alps, Italy.	Dr. E. Festa (P).	9. 1. 18. 1.

DYROMYS NITEDULA WINGEI Nehring.

1881. *Eliomys dryas* Winge, Vidensk. Meddel. fra den naturh. Foren. i Kjobenhavn, 1881, p. 50 (near Athens). Not *Mus dryas* Pallas.
1902. *Myoxus wingei* Nehring, Sitz.-Ber. Gesellsch. Naturforsch. Freunde, Berlin, p. 5 (Parnassus region, Greece).
1910. *Dyromys nitedula wingei* Trouessart, Faune Mamm. d'Europe, p. 134.

Type locality.—Parnassus region, Greece.

Geographical distribution.—Known only from the type locality and from the vicinity of Athens.

Diagnosis.—Similar to *Dyromys nitedula nitedula* but skull with rostral portion less elongate, the distance from anterior root of zygoma to tip of nasal less than 8 mm., and teeth weak; upper premolar with crown area decidedly more than half that of first molar.

Colour.—The colour appears to be indistinguishable from that of *D. nitedula nitedula*.

Skull.—The only skulls examined are broken. While the brain-case does not appear to differ from that of true *D. nitedula*, the rostrum is shorter and weaker than in the allied species, though not different in form. Auditory bullæ apparently larger than in *D. n. nitedula*, but the material is not sufficient to show whether this character is constant.

Teeth.—While resembling in all essential characters those of *D. n. nitedula* the molars are distinctly less robust, particularly the first and second. As a result the premolar is larger relatively to the first molar, and the tooth-row as a whole is more nearly parallel-sided, and with less broadening at middle.

Measurements.—Two adult females from Tatoi, near Athens, Greece: head and body, 80 and 93; tail, 80 and 86; hind foot, 20 and 18·8; ear from meatus, — and 12·4.

Specimens examined.—Two, both from Tatoi, north of Athens, Greece.

Remarks.—Though at present very imperfectly known the Grecian *Dyromys* appears to be a well-characterized local form.

2.	Tatoi, Greece. (*C. Mottaz.*)	Hon. N. C. Rothschild (P).	8. 10. 2. 24–25.

CRANIAL MEASUREMENTS OF *DYROMYS NITEDULA* AND *D. ROBUSTUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Mastoid breadth.	Interorbital constriction.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
D. nitedula nitedula.												
Austria-Hungary: Zuberec, North Hungary	94. 3. 1. 37		—	15·2	—	4·0	8·8	6·4	14·8	3·8	3·8	Teeth slightly worn.
,, ,,	94. 3. 1. 38		—	—	—	4·0	8·6	6·0	14·2	3·8	3·8	,, not worn.
,, ,,	—		—	—	—	4·2	8·2	5·6	14·0	3·8	4·0	,, ,,
D. nitedula intermedius.												
Switzerland: Vulpera-Tarasp .	26 Rothschild	♂	24·4	14·2	12·0	4·2	8·8	5·8	14·0	3·8	3·8	,, slightly worn.
,, .	,,	♂	25·2	15·2	12·6	4·2	9·4	6·0	14·4	4·0	4·0	,, ,,
Italy: Padola, Cadore . .	9. 1. 18. 1		24·2	14·6	12·6	4·2	8·8	6·2	13·8	3·8	3·8	,, ,,
,, ,, . .	174695	♂	24·0	15·2	12·6	4·2	8·6	6 2	13·8	3·8	4·0	,, ,,
D. nitedula wingei.												
Greece: Tatoi, near Athens .	8. 10. 12. 24	♀	23·5±	14·0	12·2	4·0	8·0	5·8	13·6	3·6	3·6	,, much worn.
,, ,, .	8. 10. 12. 25	♀	—	—	—	3·8	7·6	5·6	13·6	3·6	3·6	,, ,,
D. robustus.												
Bulgaria: Rustschuk . .	11. 10. 8. 1*	♀	25·6	16·8	13·6	4·2	—	6·6	15·2	3·8	4·2	,, slightly worn.

* Type.

DYROMYS ROBUSTUS Miller.

1910. *Dyromys robustus* Miller, Ann. and Mag. Nat. Hist., 8th ser., VI, p. 459, November, 1910. Type in British Museum.

Type locality.—Rustschuk, Bulgaria.

Geographical distribution.—Known from the type locality only.

Diagnosis.—Like *Dyromys nitedula* but skull broader and more robust, with relatively shorter rostrum and much enlarged auditory bullæ.

External characters and colour. Not appreciably different from those of *D. nitedula* (no skins examined).

Skull and teeth.—Skull of essentially the same length as in the largest specimens of *Dyromys nitedula*, but conspicuously broader and more robust; brain-case relatively shorter and broader, its width above zygomatic roots nearly equal to distance from posterior border of interparietal to narrowest portion of interorbital constriction, its posterior outline appearing more squarely truncate when viewed from above, and wider and lower when viewed from behind; in lateral aspect, owing to the enlarged bullæ, the brain-case appears deeper than in the related species; auditory bullæ of the same form as in *D. nitedula*, but so enlarged that their length from paroccipital process is nearly equal to distance from front of bulla to infraorbital foramen; mandible heavy but with no special peculiarities of form. Teeth with enamel pattern as in *D. nitedula*; relative size of upper premolar about as in *D. n. wingei*.

Measurements.—Type (adult female in alcohol): head and body, 95; tail, 87; hind foot, 22; ear from meatus, 15. For cranial measurements see Table, p. 571.

Specimen examined.—The type.

♀ al.	Rustschuk, Bulgaria.	K. Andersen (c).	11. 10. 8. 1. (*Type* of species.)

Genus GLIS Brisson.

1762. *Glis* Brisson, Regn. Anim. in Classis IX distrib., 2nd ed., p. 13 (*Glis*).
1780. *Myoxus* Zimmermann, Geogr. Gesch., II, p. 351 (Type by tautonymy *Sciurus glis* Linnæus).
1843. *Myoxus* Wagner, Abhandl. kais Bayer. Ak. Wissensch., München, Math.-Phys. Classe III, p. 185 (Sub-genus of *Myoxus*).
1857. *Glis* Blasius, Säugethiere Deutschlands, p. 288 (Sub-genus of *Myoxus*).
1890. *Myoxus* Reuvens, Die Myoxidae oder Schlaefer, p. 56 (Sub-genus of *Myoxus*).
1895. *Glis* Merriam, Science, N.S., I, p. 376, April 5, 1895 (Genus).
1900. *Elius* Schulze, Zeitschr. für Naturwiss., Stuttgart, LXXIII, p. 200 (Sub-genus of *Myoxus*) part, included *glis* and *nitedula*.

Type species.—*Glis* Brisson = *Sciurus glis* Linnæus.

Geographical distribution.—Central and southern Europe from

the Atlantic coast of the mainland east to Asia Minor, north to northern Germany, south to Sicily, Sardinia and northern Spain.

Characters.—Skull flattened, slightly angular, the interorbital region with lateral ridges which unite to form a median crest in old age; brain-case rather broad and low, the auditory bullæ moderate; ectopterygoid reduced to a low ridge; jugal very long in front, extending almost or quite to lachrymal; mandible with angular portion entire; dental formula as in *Eliomys;* crowns of cheek-teeth very slightly concave, the inner and outer margins scarcely elevated, the outer side of m^1 and m^2 with five low cusps; crowns of m^1 and m^2 alike in form, each crossed by four complete transverse ridges, in the spaces between which lie three incomplete ridges; external appearance squirrel-like, the tail conspicuously distichous.

Remarks.—The single known member of this genus is one of the most characteristic mammals of central and southern Europe. In the mechanics of the zygomatic arch *Glis* is more sciurine than any of the other European members of the family. The structure of the teeth and the peculiarities of external form are less specialised than in *Muscardinus.*

GLIS GLIS Linnæus.

(Synonymy under subspecies.)

Geographical distribution.—From the northern portion of the Iberian Peninsula to Asia Minor; north to the Baltic coast of Germany; south to Sardinia and Sicily; west to the Atlantic.

Diagnosis.—General characters as in the genus; size largest of the European *Muscardinidæ* (head and body about 160 to 190; hind foot about 27 to 34; condylobasal length of skull about 36 to 44); colour greyish above, whitish below, the tail usually darker or more slaty than body; no blackish markings anywhere.

External characters.—General form and appearance squirrel-like. Details of structure much as in *Eliomys quercinus* except in the following particulars. Ear much smaller, extending barely to eye when laid forward; scarcely a trace of ridge on inner surface of conch, but meatus with a small though evident antitragus-like lobe. Feet more robust than in the other European members of the family, but relative lengths of digits as in *Eliomys;* tubercles larger relatively to the area in which they occur; postero-internal palmar tubercle divided into two nearly equal parts, on the outer surface of the anterior of which an exceedingly small remnant of the thumb nail may usually be detected. Sole rather broad and robust, hairy on posterior third, its tubercles not differing noticeably among themselves in form, the postero-internal tubercle not elongated, but the three posterior

larger than the three anterior. Claw of inner toe relatively more reduced, closely appressed to pad. Tail easily broken as in *Eliomys* and showing the same tendency to produce an abnormally thickened pencil when injured, its hairs long throughout, its form strictly distichous in adult, but terete through basal half in young. Mammae : $p\ 2-2$, $a\ 2-2$, $i\ 2-2 = 12$.

Colour.—Upper parts ranging from a yellowish broccoli-brown to bluish smoke-grey, a little darkened on back by a sprinkling of long blackish hairs; underfur slate-grey at base, the general body colour appearing at extreme tips only; hairs unusually glossy throughout, producing a noticeable metallic silvery lustre, especially on posterior half of back; head faintly lighter than body; a narrow dusky eye-ring; ears like surrounding parts or somewhat dusky; underparts and inner surface of legs pale buff, the line of demarcation rather well defined and extending on cheek to lower edge of eye-ring; feet dull pale buff, irregularly clouded with dusky or plumbeous; tail with upper surface essentially like back but usually darker or more slaty, its under surface lighter, with ill-defined pale median stripe sometimes extending nearly to pencil but more often indistinct beyond middle. Young dull plumbeous grey above, buffy white below, the light area on under side of tail usually better defined than in adult.

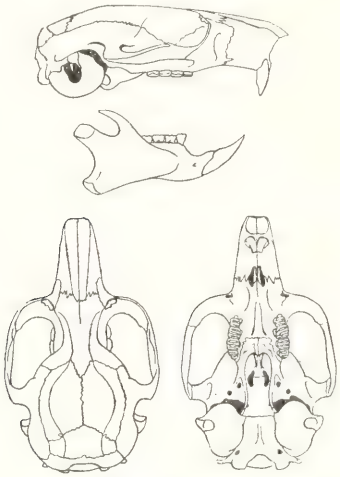

FIG. 113.
Glis glis. Nat. size.

Skull.—In general the skull differs from that of *Eliomys quercinus* chiefly in its broader, lower form, a peculiarity that is especially noticeable in posterior view. Profiles essentially as in

E. quercinus except that nasals are abruptly bent downward at tip and ventral border of auditory bulla does not descend evidently below level of pterygoids. Surface of brain-case smooth, its general outline between squarish and ovate when viewed from above, the parietals bent downward along outer edge as in *Eliomys;* interparietal lozenge-shaped, its antero-posterior diameter about half transverse diameter, rarely approaching ligulate. Auditory bulla much less inflated than in *Eliomys*, particularly in its posterior portion, which is not visible when skull is viewed from above, and is not closely appressed to paroccipital process, the general outline of bulla from side sub-circular, the anterior border extending about to posterior border of glenoid surface; width of basioccipital at basal suture considerably more than half distance from suture to foramen magnum instead of barely one-third this distance as in *Eliomys*. Interorbital region with well developed lateral ridges, low in the young, becoming higher in adults and finally uniting to form a median crest. Zygomata more abruptly spreading than in *Eliomys*, their median portion often parallel, the middle of each jugal angularly expanded upward, the zygomatic process of squamosal with abrupt posterior concavity when viewed from above. Posterior termination of nasals pointed or truncate, about at level of nasal branch of premaxilla and front of lachrymal. Incisive foramina as in *Eliomys* but shorter, the greatest length about one-third that of diastema. Palate and mesopterygoid space essentially as in *Eliomys*, but hamular not in contact with bulla, and ectopterygoid reduced to a low ridge. Mandible much more robust than that of *Eliomys*, especially in its anterior portion; coronoid process more robust, strongly curved, its point high above level of condyle; angular portion entire.

Teeth.—Incisors as in *Eliomys* but more robust. Upper cheek-teeth relatively larger than in *Eliomys*, their outlines squarish, the first and second molars sub-equal, the third smaller, narrowed posteriorly; premolar slightly less than half as large as first molar. Crowns low and nearly flat, but inner and outer border slightly raised. The crown of each tooth is crossed by four complete ridges, the posterior of which is least developed; between these three incomplete ridges extend inward to or a little beyond middle, the second reaching outer side. These ridges are best developed in m^1 and m^2, least developed in the premolar, in which the first is often absent. Inner border of crown with four low tubercles formed by the inner extremities of the four main ridges, the fourth smaller than any of the others. Outer margin of m^1 and m^2 with five similar but smaller tubercles formed by the outer extremities of the four main ridges and the middle incomplete ridge. In the premolar the incomplete ridge does not extend to outer margin of crown, while in m^3 the structure of all the ridges becomes indefinite near periphery of crown. Lower molars essentially like the maxillary teeth, but with

arrangement reversed, the thicker more tuberculate termination of ridges at outer side of crown, and none of the intermediate ridges extending to border; lower premolar usually with only

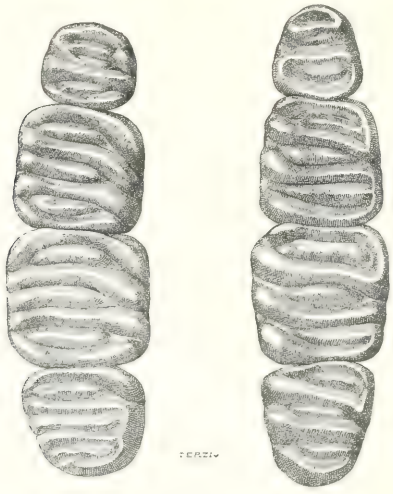

FIG. 114.
Glis glis. Cheek-teeth. × 10.

two incomplete ridges (the second and third); m_3 with crown longer and all the ridges better developed than in m^3.

Remarks.—*Glis glis* is immediately recognizable among European members of the family by its large size, squirrel-like aspect, and the absence of dark markings on face. Three local races are known to occur in Europe and a fourth in Asia Minor. A fifth, which I have not seen, has been described from northern Spain.

KEY TO THE EUROPEAN RACES OF *GLIS GLIS*.

Size medium, hind foot usually less than 30 mm.; condylobasal length of skull usually 35 to 39 mm. (Central Europe, south to northern Italy)..... *G. glis glis*, p. 577.
Size large, hind foot usually more than 30 mm.; condylobasal length of skull usually 39·6 to 44 mm.
  Skull frequently more than 42 mm. in condylobasal length; dark terminal area of tail often involving distal half or more (Italy and Sicily)..... *G. g. italicus*, p. 578.
  Skull rarely more than 41 mm. in condylobasal length; dark terminal area of tail usually confined to distal third or less (Sardinia)..... *G. g. melonii*, p. 579.

Glis glis glis Linnæus.

1766. [*Sciurus*] *glis* Linnæus, Syst. Nat., I, 12th ed., p. 87 (Central Europe).
1779. [*Glis*] *esculentus* Blumenbach, Handb. der Naturgesch., p. 79 (Central Europe).
1816. *Glis vulgaris* Oken, Lehrbuch der Naturgesch., III, pt. 2, p. 868 (Germany).
1832. ? *M*[*yoxus*] *giglis* F. Cuvier, N. Ann. Mus. d'H. N. Paris, I, p. 444. Nomen nudum, "le loir proprement dit."
1840–45. *Myoxus avellanus* Owen, Odontography, II, p. 25, pl. 105.
1857. *Myoxus glis* Biasius, Säugethiere Deutschlands, p. 292.
1890. *Myoxus glis* Reuvens, Die Myoxidae oder Schlaefer, p. 61.
1895. *Gtis* (sic) *glis* Merriam, Science, N.S., I, p. 376, April 5, 1895.
1910. *Glis glis* Trouessart, Faune Mamm. d'Europe, p. 131.

Type locality.—Germany.

Geographical distribution.—Central Europe from northern Germany (Mecklenburg) to the Pyrenees and northern Italy, and from the Atlantic coast eastward.

Diagnosis.—Size medium, the hind foot about 30 mm. or less, the condylobasal length of skull about 35 to 39 mm.; molars not enlarged; general colour of upper parts a yellowish broccoli-brown scarcely darkened by the longer blackish hairs; tail essentially concolor with body, the extremity usually tinged with drab, but hardly ever noticeably darker than basal portion.

Measurements.—Adult male from Zürich, Switzerland: head and body, 165; tail, 150; hind foot, 29. Adult male from Bruggen, St. Gallen, and adult male from Mels, Rheinthal, St. Gallen: head and body, 180 and 170; tail, 120 and 130; hind foot, 28 and 29. Adult female from Hatszeg, Hunyad, Hungary: head and body, 147; tail, 135; hind foot, 29·4. Adult male and female from Ceresole d'Alba, Turin, Italy: head and body, 170 and 176; tail, 146 and 149; hind foot, 27·4 and 27. Sixteen adults from various localities in northern Italy (Genoa): hind foot, 27 to 28·5. For cranial measurements see Table, p. 580.

Specimens examined.—Ninety-two, from the following localities:—
France: No exact locality, 5; near Nîmes, Gard, 4.
Germany: Saxony, 1 (U.S.N.M.); Bavaria, 1 (U.S.N.M.); Marxheim, Bavaria, 2; Ekernkrug, 1.
Austria-Hungary: Steiermark, 1; Hollós, Eisenburg, 1 (U.S.N.M.); Trieste, 1; Herkulesbad, 1; Hatszeg, Hunyad, 6.
Switzerland; Les Plans, Vaud, 3 (U.S.N.M.); Interlaken, Bern, 1 (U.S.N.M.); Mürren, Bern, 1; Lucerne, 1; St. Gothard, Uri, 1; Zürich, 1 (U.S.N.M.); Thayngen, Schaffhausen, 2 (B.M. and U.S.N.M.); Bruggen, St. Gallen, 1 (U.S.N.M.); Degersheim, St. Gallen, 2 (U.S.N.M.); Toggenburg, St. Gallen, 1 (U.S.N.M.).; Mels, St. Gallen, 2 (B.M. and U.S.N.M.); Wolfhalden, Appenzell, 1 (U.S.N.M.); Biasca, Ticino, 1 (U.S.N.M.); Buggiolo, Ticino, 1 (U.S.N.M.); Carmago, Ticino, 2 (U.S.N.M.); Lonvico, Ticino, 1 (U.S.N.M.); Vezia, Ticino, 1 (U.S.N.M.); no exact locality, 1.
Italy: Padola, Cadore, 1 (Turin); Porlezza, Como, 23 (Ghidini);

Gozzano, Novara, 3 (Genoa); Ceresole d'Alba, Turin, 10 (Turin); Moncalieri, Turin, 7 (Turin).

2 ♂, 2 ♀.	Nîmes, Gard, France. (*C. Mottaz.*)	O. Thomas (P).	8. 8. 10. 53–56.
2, 2 juv.	France.	Purchased (Lefebvre).	46. 1. 2. 1–4.
1.	France.	A. Baillon (C).	46. a.
2 ♀.	Marxheim, Bavaria. (*Schuchardt.*)	Lord Lilford (P).	11. 1. 1. 102–103.
♀.	Ekernkrug, Germany.	Lord Lilford (P).	11. 1. 1. 104.
1.	Trieste, Austria-Hungary. (*J. G. Haggard.*)	Lord Lilford (P).	11. 1. 1. 152.
♂.	Herkulesbad, Austria-Hungary. (*F. J. Cox.*)	Hon. N. C. Rothschild (P).	7. 9. 16. 11.
4 ♂, 2 ♀.	Hatszeg, Hunyad, Transylvania.	C. G. Danford (C).	3. 11. 8. 21–26.
1.	Mürren, Bern, Switzerland.	W. Gürtner (C & P).	92. 10. 5. 4.
1.	Lucerne.	E. Cavendish Taylor (C & P).	5. 5. 6. 15.
1.	St. Gothard, Uri, Switzerland. (*Verreaux.*)	Tomes Collection.	7. 1. 1. 75.
♀ juv.	Thayngen, Schaffhausen. (*E. H. Zollikofer.*)	O. Thomas (P).	2. 8. 4. 35.
♀.	Mels, St. Gallen. (*E. H. Zollikofer.*)	O. Thomas (P).	2. 8. 4. 34.
♂ st.	Switzerland.	E. R. Alston (P).	79. 9. 12. 1.

Glis glis italicus Barrett-Hamilton.

1898. *Glis italicus* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., II, p. 424, November, 1898 (Siena, Italy). Type in British Museum.

1899. ? *Glis insularis* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., III, p. 228, March, 1899, Monte Aspro, near Palermo, Sicily. Type in British Museum.

1910. *Glis italicus* and ? *Glis insularis* Trouessart, Faune Mamm. d'Europe, p. 132.

Type locality.—Siena, Italy.

Geographical distribution.—Italy, from region of Genoa, southward; Sicily?

Diagnosis.—Larger than *Glis glis*, the hind foot more than 30 mm., the condylobasal length of skull about 40 to 44 mm.; cheek-teeth distinctly enlarged; the incomplete cross ridges tending to be better developed; general colour of upper parts a clear broccoli-brown noticeably darkened by the longer blackish hairs; tail usually much darker than body, its terminal half drab, slaty, or occasionally blackish.

Measurements.—Adult male from the type locality: head and body, 190; tail, 152; hind foot, 33; ear from meatus, 24. Type and a second adult female from the type locality: head and body, 180 and 187; tail, 153 and 130 (probably injured); hind foot, 34 and 33·4; ear from meatus, 23 and 23. Adult female from Monte Sirino, Lagonegro: head and body, 175; tail, 150;

hind foot, 34; ear from meatus, 21. Young female from near Palermo, Sicily (type of *insularis*): head and body, 160; tail, 130; hind foot, 31; ear from meatus, 21. For cranial measurements see Table, p. 581.

Specimens examined.—Forty, from the following localities in Italy: near Genoa, 5; Tana del Mosto, Finalborgo, Genoa, 1 (Genoa); Perti, Finalborgo, Genoa, 6 (Genoa); near Vittoria, western Liguria, 2 (Genoa); Caluzzano, 1 (Genoa); Malasana, 2 Genoa); near Montariolo, 1 (Genoa); Verona, 1; Florence, 1; Siena, 8; Viterbo, near Rome, 2; Monte Cimino, Rome, 7 (Genoa); Monte Sirino, Lagonegro, 1; near Palermo, Sicily, 2.

Remarks.—Throughout southern and central Italy, north to about the region of Genoa, the large dormouse appears to be very constant in its characters, differing from that of central Europe in its greater size and heavier teeth, as well as in its somewhat darker coloration. Further north, notably in the region of Turin and at Porlezza, the colour becomes essentially as in true *glis*, but the size remains a little above that of the typical form. These northern specimens are probably best treated as intermediates between *glis* and *italicus*, lying nearer to the former than to the southern race. The two immature specimens from Sicily which formed the basis of *Glis insularis* are in very bad condition. Allowance being made for this, there appears to be nothing to distinguish them from the ordinary south-Italian form.

2 ♀.	Genoa, Italy.	Genoa Museum (E).	7. 2. 28. 1–2.
♂, 2 ♀.	Genoa.	Marquis G. Doria (P).	89. 12. 11. 1–3.
♀.	Verona. (*Conte delle Oddi.*)	O. Thomas (P).	99. 11. 10. 4.
♀.	Florence.	A. Savage Landor (C & P).	97. 3. 7. 2.
♂, 5 ♀.	Siena. (*Brogi.*)	Dr. E. Hamilton (P).	98. 10. 2. 11–16. (98. 10. 2. 14. *Type* of subspecies.)
2.	Siena. (*Brogi.*)	G. Barrett-Hamilton (P).	11. 1. 2. 60-61.
♀.	Monte Sirino, Lagonegro. (*A. Robert.*)	O. Thomas (P).	6. 8. 4. 1.
2 ♀.	Palermo, Sicily. (98. 10. 6. 4. *Type* of *G. insularis* Barrett-Hamilton.)	J. I. S. Whitaker (P).	98. 10. 6. 4–5.

Glis glis melonii Thomas.

1907. *Glis melonii* Thomas, Ann. and Mag. Nat. Hist., 7th ser., XIX, p. 445, May, 1907. Type in British Museum.
1910. *Glis melonii* Trouessart, Faune Mamm. d'Europe, p. 132.

Type locality.—Marcurighè, Urzulei, Ogliastra, Sardinia.

Geographical distribution.—Sardinia and probably Corsica also.

Diagnosis.—Similar to *Glis glis italicus*, but not attaining so large a size (skull rarely more than 41 mm. in condylobasal length), and dark terminal area on tail not so extensive, seldom involving more than distal third.

CRANIAL MEASUREMENTS OF *GLIS GLIS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Mastoid breadth.	Interorbital constriction.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
G. glis glis.												
France: Nîmes, Gard	8. 8. 10. 55	♀	35·4	23·0	16·0	5·0	13·0	9·6	22·0	6·6	6·8	
,, ,,	8. 8. 10. 56	♀	—	23·0	16·0	5·0	12·8	9·4	22·4	6·8	6·6	
,, ,,	152760		36·0	23·0	17·0	5·0	13·0	10·0	23·0	7·0	6·8	Teeth slightly worn.
Germany: Marxheim, Bavaria	152758		35·0	22·2	16·4	5·0	13·0	9·2	22·6	6·6	7·0	,, ,,
,, ,,			36·0	23·2	16·0	5·0	12·8	9·6	23·0	6·8	7·0	,, ,,
,, ,,	11. 1. 1. 102	♀	37·0	23·2	16·4	5·0	13·0	9·2	23·0	6·6	6·8	
,, ,,	11. 1. 1. 103	♀	37·2	23·6	16·6	4·8	13·6	9·4	23·0	7·0	7·0	
Austria-Hungary: Herkulesbad	7. 9. 16. 11	♂	35·8	22·2	16·0	5·0	12·6	9·4	22·4	6·6	6·6	,, ,,
Hatszeg, Hunyad	3. 11. 8. 25	♀	—	23·0	—	5·0	13·2	9·2	23·0	6·8	7·0	,, ,,
,, ,,	3. 11. 8. 26	♀	36·6	23·0	17·0	5·0	13·0	9·6	23·6	7·0	7·4	,, ,,
Trieste	11. 1. 1. 152.		—	24·8	—	5·0	13·8	10·4	25·0	—	7·4	,, moderately worn.
Switzerland: Les Plans, Vaud.	104500	♂	37·4	23·6	17·2	5·2	13·6	9·4	24·6	6·8	7·0	,, ,,
Degersheim, St. Gallen	123649	♂	36·8	23·0	16·6	5·0	—	9·6	23·2	6·8	7·0	,, slightly worn.
Zürich	104497	♂	37·2	23·8	16·8	5·0	13·4	9·8	24·2	6·8	7·0	,, moderately worn.
Wolfhalden	145171	♂	37·4	24·0	16·8	5·0	13·4	9·8	23·6	7·0	7·2	,, ,,
Italy: Padola, Cadore	Turin 25	♀	35·8	22·2	16·2	5·2	12·0	9·2	22·4	6·8	7·2	,, slightly worn.
Porlezza, Como	Mo. 182 Mottaz	♂	38·8	23·8	16·8	5·0	14·2	10·6	24·8	6·6	7·0	,, ,,
,, ,,	Mo. 181 Mottaz	♀	38·6	24·6	17·2	5·2	13·4	10·2	25·0	6·6	7·0	,, ,,
,, ,,	Mo. 183 Mottaz	♀	37·2	23·6	16·8	5·2	13·2	10·0	24·6	6·8	7·0	,, ,,

Italy: Ceresole d'Alba, Turin .	Turin 1	♂	38·2	25·0	16·2	5·0	12·2	10·0	23·0	6·6	7·0	Teeth moderately worn.
,, ,, .	,, 3	♀	37·2	24·2	17·0	5·0	12·8	9·8	23·2	6·6	6·8	,, ,,
,, ,, .	,, 4	♀	38·0	24·6	17·2	5·2	13·2	9·6	25·0	7·0	7·2	,, ,,
,, ,, .	,, 5	♀	37·8	25·0	17·2	5·0	13·4	10·0	24·0	6·6	6·8	,, ,,
G. glis italicus.												
Italy: near Genoa . . .	7. 2. 28. 1	♀	40·0	25·0	17·8	5·2	13·8	10·4	25·2	7·4	7·6	,, slightly worn.
,, ,, . . .	7. 2. 28. 2	♀	40·2	25·4	18·0	5·2	14·4	10·8	24·8	7·2	8·0	,, ,,
Siena	98. 10. 2. 12	♀	42·0	—	18·6	5·4	14·4	11·0	26·6	—	8·2	,, moderately worn.
,, ...	98. 10. 2. 14*	♀	42·4	27·0	18·4	5·2	15·0	11·6	27·0	7·4	8·0	,, ,,
,, ...	98. 10. 2. 15	♀	40·0	24·8	17·6	5·2	14·2	10·2	26·0	7·6	8·0	,, ,,
,, ...	98. 10. 2. 11	♂	—	25·4	—	5·2	15·0	11·2	25·4	7·2	7·8	,, ,,
Monte Cimino, Rome .	Genoa	♂	44·0	27·0	19·0	5·4	16·2	11·4	26·6	8·0	8·0	Interorbital ridges joined.
,, ,, ,, .	,,	♂	42·6	26·4	18·8	5·4	15·0	11·0	27·0	7·8	8·0	Interorbital ridges nearly joined.
,, ,, ,, .	,,	♀	43·0	26·4	18·4	5·4	14·6	11·2	27·0	7·8	8·0	Interorbital ridges joined.
Monte Sirino . .	6. 8. 4. 1	♀	39·4	25·0	17·4	5·2	13·2	10·2	24·0	8·0	8·0	Teeth slightly worn.
Sicily: Palermo . . .	98. 10. 6. 4†	♀ juv.	—	—	—	5·4	—	10·0	23·4	7·0	8·0	,, not worn.
,, . . .	98. 10. 6. 5	♀ juv.	—	—	—	5·4	—	10·2	23·4	7·0	8·0	,, ,,
G. glis melonii.												
Sardinia: Urzulei . . .	8. 4. 6. 1*	♂	39·6	24·8	17·0	5·4	13·8	10·6	25·2	7·6	7·6	,, moderately worn.
,, . . .	8. 4. 6. 4	♀	40·4	25·0	17·4	5·2	14·0	10·8	25·0	7·6	8·0	,, slightly worn.
,, . . .	8. 4. 6. 5	♀	39·4	23·6	17·0	5·0	13·4	10·0	24·8	8·0	8·2	,, not worn.
Montenieddu . .	Genoa	♂	39·6	24·6	17·0	5·0	13·2	11·0	24·8	7·8	7·8	Interorbital ridges nearly joined.
,, . .	,,	♂	40·0	—	18·0	5·4	14·6	11·2	25·0	7·8	7·8	,, ,,

* Type.

† Type of *insularis* Barrett-Hamilton.

Measurements.—Type (adult male): hind foot, 32·6. Two other adult males from the type locality: head and body, 154 and 160; tail, 134 and 142; hind foot, 30 and 32; ear from meatus, 20 and 20. Adult female from the same locality: head and body, 165; tail, 134; hind foot, 32; ear from meatus, 20. For cranial measurements see Table, p. 581.

Specimens examined.—Twenty-four, all from Sardinia (B.M. and Genoa).

Remarks.—Although not a strongly marked race the Sardinian *Glis* differs appreciably in average characters from that of the Italian mainland. Its most obvious features are the slightly smaller size and less darkened tail.

6 ♂, 5 ♀.	Sardinia.	G. Meloni (c).	8. 4. 6. 1–11.
		(8. 4. 6. 1. *Type* of subspecies.)	

Note.—The Spanish form of *Glis* has been distinguished subspecifically from the other European races. I have not seen the animal, and the following account is taken entirely from the original description.

Glis glis pyrenaicus Cabrera.

1908. *Glis glis pyrenaicus* Cabrera, Ann. and Mag. Nat. Hist., 8th ser., I, p. 193, February, 1900.

Type locality.—Allo, Navarra, Spain.

Geographical distribution.—Northern Spain: exact limits of range unknown.

Diagnosis.—Similar to the typical form in all essential respects, but readily distinguishable by larger skull, and strong buffy tinge of back.

Colour. Upper parts buffy grey, the hairs being iron-grey with yellowish buff ends. In the middle of the back there are numerous black hairs, showing a bright metallic gloss. Under surface creamy white, separated from the upper colour by a narrow, ill-defined zone of pure yellowish buff extending from the cheek to the hip. Tail glossy brownish grey, with the usual whitish line along under side. Ears and orbital rings brown. Hands and feet white; a broad brown metatarsal patch.

Skull. Like that of typical *G. glis*, but larger, approaching that of *Glis glis italicus*.

Measurements.—Type (in flesh): head and body, 169; tail-vertebræ, 137; hind foot, 28; ear, 16. Skull: greatest length, 41·5; basilar length, 33; zygomatic breadth, 24; breadth of brain-case, 18; interorbital breadth, 5·5; length of nasals, 14; palatilar length, 16; diastema, 10; upper tooth-row, 7·5.

Genus **MUSCARDINUS** Kaup.

1829. *Muscardinus* Kaup, Entw.-Gesch. u. Natürl. Syst. Europ. Thierwelt, I, p. 134.
1843. *Muscardinus* Wagner, Abhandl. k. Bayer. Akad. Wissensch., München, Math.-Phys. Cl., III, p. 185 (Sub-genus of *Myoxus*).
1857. *Muscardinus* Blasius, Säugethiere Deutschlands, p. 289 (Sub-genus of *Myoxus*).
1890. *Muscardinus* Reuvens, Die Myoxidae oder Schlaefer, p. 25 (Sub-genus of *Myoxus*).

Type species.—*Mus avellanarius* Linnæus.

Geographical distribution.—From England east into Asia Minor and from central and southern Sweden to the Mediterranean coast and Sicily, though not at present known from the Iberian and Balkan Peninsulas.

Characters.—Skull deep, as in *Eliomys* and *Dyromys*, but interorbital region flattened, with slightly raised edges, its median portion usually with one or two small irregular perforations at narrowest part; ectopterygoid absent; jugal moderately long in front, extending about half-way up anterior border of orbit; mandible with angular portion fenestrate; dental formula as in the other European members of the family; crowns of cheek-teeth essentially flat, the margins not elevated, the outer border of m^1 and m^2 with five or six low cusps; crowns of m^1 and m^2 conspicuously unlike in size and form, the five cross ridges of the larger first molar mostly oblique, the seven ridges of the smaller second molar strictly transverse; external form not peculiar; tail long, moderately bushy; feet more specialized than in the other European members of the group.

Remarks.—This genus with its flat-crowned molars and unusually prehensile feet represents the most highly specialized stage attained by the European *Muscardinidæ*. As might be anticipated the habits of the species are more strictly arborial than in the other genera. Three species are now known, two of which occur in Europe, the other in Asia Minor.

KEY TO THE EUROPEAN SPECIES OF *MUSCARDINUS*.

Upper parts dull yellowish brown; no sharp line of demarcation along sides; no white stripe between ear and eye (Distribution general)... *M. avellanarius*, p. 583.
Upper parts bright buff; a sharp line of demarcation along sides; a vertical white stripe between ear and eye (Central Italy) ..... *M. pulcher*, p. 590.

MUSCARDINUS AVELLANARIUS Linnæus.

1758. [*Mus*] *avellanarius* Linnæus, Syst. Nat., I, 10th ed., p. 62 (Sweden).
1782. *Myoxus muscardinus* Schreber, Säugthiere, pl. CCXXVII; text, IV, p. 835, 1788 (Germany).
1858. *Myoxus avellanarius* Blasius, Säugethiere Deutschlands, p. 297.

1869. *Mus corilinum* Fatio, Faune Vert. Suisse, I, p. 183 (name attributed to Schreber).

1890. *Muscardinus avellanarius* Reuvens, Die Myoxidae oder Schlaefer, p. 69.

1900. *M[uscardinus] avellanarius anglicus* Barrett-Hamilton, Proc. Zool. Soc., London, p. 86 (Bedford Purlieus, Thornhaugh, Northamptonshire, England). Type in British Museum.

1910. *Muscardinus avellanarius* and *M. avellanarius anglicus* Trouessart, Faune Mamm. d'Europe, p. 135.

Type locality.—Central Sweden.

Geographical distribution.—Throughout central Europe from England eastward; north to central Sweden, south to the Pyrenees and to Rome, Italy.

Diagnosis.—Smallest European member of the family, the general size not much greater than that of a large house mouse; colour dull yellowish brown above, buffy beneath, the chin and throat usually whitish, the flanks between the clay-colour and ochraceous-buff of Ridgway; no whitish stripe in front of ear.

External characters.—General form essentially as in *Eliomys quercinus*, but eye relatively larger and more prominent, ear relatively shorter (extending to outer canthus of eye when laid forward), its inner surface with conspicuous ridge above meatus as in *Dyromys*, and tail uniformly haired throughout. Fore foot with digits relatively longer than in the other European genera, and closing obliquely inward so as to come in opposition with the much enlarged inner tubercle, the unusual size of which, about equal to that of all the other tubercles together, enables it to function as a low, broad thumb; terminal lobe of this tubercle representing true thumb small though evident; proportional lengths of fingers as in *Eliomys*. Hind foot rather short and broad, as in *Glis*, the sole naked to heel, the two inner tubercles somewhat enlarged, but not specially elongated; inner digit a mere rudiment scarcely larger than its corresponding tubercle, its claw obsolete; other digits relatively longer than in the related genera. Tail partly prehensile, slightly flattened, extending about to ears when laid forward, uniformly haired and loosely short-bushy throughout. Mammæ: $p\,1-1,\ a\,1-1\ i\,2-2=8$.

Colour.—Entire upper parts and outer surface of legs yellowish brown, the exact shade between the wood-brown or clay-colour and buff of Ridgway, sometimes with a slight greyish or ecru-drab cast across shoulders, the middle of back inconspicuously sprinkled with blackish hairs; sides, flanks, cheeks and ears tinged with ochraceous-buff; tail concolor with back above, faintly lighter below, the tip with a dusky tinge; underparts and inner surface of legs light ochraceous-buff, slightly contrasted with sides and without sharp line of demarcation, the hairs, like those of back, slate-grey at base; chin and throat with an irregular area of pure white (to base of hairs), this occasionally

extending back along median line to middle of belly, but anteriorly seldom covering lower lip and never extending upward between ear and eye; a family indicated, very narrow blackish eye-ring; feet ochraceous-buff, the toes sprinkled with silvery hair.

Skull.—In general form the skull differs from that of the other European *Muscardinidæ* in greater depth of brain-case, particularly at its anterior portion, the posterior half sloping away much more noticeably than in the allied genera, the occipital region low. Interparietal usually narrowed to a point at each lateral extremity. Auditory bulla essentially as in *Glis*, but a little more inflated posteriorly, so as to be just visible when skull is viewed from above. Interorbital region with longitudinal median depression and slightly though distinctly angular-elevated edges, the elevated regions never coming together in old age. Zygomata very abruptly spreading anteriorly so that the arches of the two sides are essentially parallel through the greater part of their extent; infraorbital foramen relatively smaller and more nearly circular in outline than in any of the other European members of the family. Nasals and nasal branches of premaxillaries terminating at level of front of lachrymal, the posterior border of nasals usually angulate-emarginate. Incisive foramina not widened behind middle, their aspect more *Murine* than *Muscardinine*. Posterior border of palate emarginate to level of middle or front of m^2, the palatine bones reduced to a mere rim at front of mesopterygoid space. Pterygoid fossa and ectopterygoid absent. Mesopterygoid fossa parallel-sided, about three times as long as wide; hamulars long and very slender, a little curved upward. Mandible relatively more robust than in any of the other European members of the family; dental foramen noticeably above alveolar level; hamular process short, its point scarcely rising above level of condyle; angular region robust, very sharply angled below; a distinct vacuity above angle.

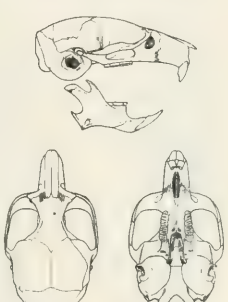

FIG. 115.
Muscardinus avellanarius.
Nat. size.

Teeth.—In general aspect the cheek-teeth differ from those of the other European *Muscardinidæ* in their relatively greater size, the flatness of their crowns, and in the more marked contrasts of size and form shown by the premolar and first two molars. Upper incisor with no special peculiarities. Lower incisor with root extending distinctly beyond that of m_3 and forcing the dental foramen upward to a level slightly above that of crushing surface of molar crowns. Premolar both above and below small, single rooted, its crown variable in outline, but

usually subterete or a little flattened against succeeding tooth, its area about one-fifth that of first molar ; cross ridges two or sometimes three, the third smaller than the others and lying at back of upper tooth and front of lower tooth, the two main ridges of upper premolar usually joined at inner side, and occasionally at outer side also, producing a circular, raised rim. Milk premolar minute, not functional, its crown bluntly spicular, smooth, scarcely one-quarter as large as that of permanent tooth. First upper molar about one-half greater than that of second, its length decidedly greater than its width, the anterior border oblique, not so long as posterior border, the inner border with a slight though abrupt emargination anteriorly ; surface crossed by five high, very distinct ridges, the first three wider apart than the last two and sloping obliquely backward toward inner margin, the first independent of the others, the second, third, fourth, and fifth continuous with a ridge which extends along inner border as far forward as space separating first ridge from the others ; when viewed from the side the outer terminations of the five ridges have the appearance of five low cusps, decreasing regularly in height from before backward ; on inner margin there is a single anterior cusp, the rest of the crown appearing flat. In some specimens there is a rudimentary ridge at extreme anterior border of tooth and traces of another in the space between third and fourth main ridges. Second upper molar squarish in outline, its length slightly greater than its width ; surface of crown crossed by seven low but complete, squarely transverse, equally spaced ridges, all* extending from border to border, the outer extremities appearing as five or six low cusps. Third upper molar like second, but smaller and with posterior border rounded, the ridges behind the first three or four usually incomplete and confused. Lower molars essentially alike in structure, the crown of each tooth crossed by six ridges rather more distinct than those of m^2 (except in m_3), their terminations producing the usual effect of low cusps along outer border ; crown area diminishing regularly from m_1 to m_3 (which is only a little more than half that of anterior tooth) ; m_2 and m_3 squarish in outline, slightly longer than wide ; m_1 decidedly longer than wide, narrower anteriorly than posteriorly.

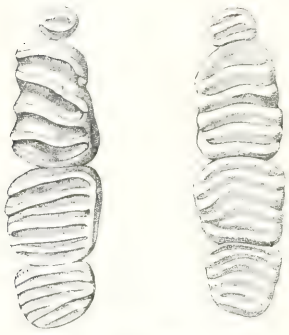

FIG. 116.
Muscardinus avellanarius.
Cheek-teeth. × 10.

* Except occasionally the third.

Measurements.—Adult male from Thornhaugh, Northamptonshire, England:* head and body, 86; tail, 57; hind foot, 16. Adult female from Colchester, Essex: head and body, 77; tail, 55; hind foot, 16; ear from meatus, 11. Adult male and female from Guines, Pas-de-Calais, France: head and body, 72 and 77; tail, 71 and 74; hind foot, 16·2 and 16·4. Adult male and female from Lucinges, Haute-Savoie, France: head and body, 78 and 76; tail, 61 and 66; hind foot, 15 and 15; ear from meatus, 11 and 10. Adult male from Lausanne, Vaud, Switzerland: head and body, 75; tail, 77; hind foot, 16·5. Adult female from Padola, Cadore, Italy: head and body, 80; tail, 70; hind foot, 16; ear from meatus, 12. Adult female from Arsoli, Rome, Italy: head and body, 75; tail, 65; hind foot, 15·6. For cranial measurements see Table, p. 588.

Specimens examined.—Ninety, from the following localities:—

England: Thornhaugh, Northamptonshire, 1; Halton, Buckinghamshire, 1; Chalfont, Buckingham, 1; Bury St. Edmunds, Suffolk, 2; Colchester, Essex, 3; London (purchased alive in), 2; Norwood, Headley, Surrey, 1; Ratham, Sussex, 1; Sussex, no exact locality, 1; Eversley, Hampshire, 2; Honiton, Devonshire, 1; no exact locality, 1.

France: Guines, Pas-de-Calais, 2; Manonville, Meurthe-et-Moselle, 4; Cranves-Sales, Haute-Savoie, 2; Lucinges, Haute-Savoie, 2; Montauban, Haute-Savoie, 1; Scientriers, Haute-Savoie, 1 (Mottaz); no exact locality, 1.

Germany: Oberwald, near Gross, Silesia, 1; Silesia, no exact locality, 1; Wolfshau, Riesengebirge, Silesia, 1 (U.S.N.M.); Nuremberg, Bavaria, 2 (U.S.N.M.).

Austria-Hungary: Csallóköz-Somorja, Pressburg, Hungary, 3; Zubereč, Hungary, 1; Tirol, 2 (U.S.N.M.); Brassó, 1; Hatszeg, Hunyad, 5.

Switzerland: Geneva, 4 (Genoa and Mottaz); Lausanne, Vaud, 2 (U.S.N.M.); Neuchatel, 3 (U.S.N.M.); St. Gallen, 2; Züberwangen, St. Gallen, 1 (U.S.N.M.); Vulpera-Tarasp, Grisons, 5 (Rothschild); Ticino, 1 (U.S.N.M.); Lugano, Ticino, 1 (U.S.N.M.).

Italy: Padola, Cadore, 2 (Turin); Porlezza, Como, 3; Gozzano, Novara, 1 (Genoa); Moncalieri, Turin, 1 (U.S.N.M.); Timone, Borzoli, Genoa, 1 (Genoa); N.S. della Vittoria, Appennino Ligure, 9 (Genoa); Vaccarezza, 2 (Genoa); Siena, 4; Rome, 1.

Remarks.—Skins from different parts of the range of *Muscardinus avellanarius* show practically no individual variation. Adults are darker and more richly coloured than the young, though the difference is slight. British specimens are not distinguishable from those taken in Switzerland and Italy.†

♂.	Halton, Buckinghamshire, England.	Hon. N. C. Rothschild (P).	11. 1. 3. 490.
♀.	Chalfont, Buckinghamshire.	Hon. N. C. Rothschild (P).	11. 1. 3. 401.
♂.	Thornhaugh, Northamptonshire.	Rev. H. H. Slater (C & P). (*Type* of *M. a. anglicus* Barrett-Hamilton.)	99. 11. 27. 6.
♂, ♀ al.	Bury St. Edmunds, Suffolk.	Dr. Günther (C & P).	90. 5. 27. 1.

* Type of *anglicus* Barrett-Hamilton.

† The type of *anglicus* is an adult in full, rich winter pelage.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital breadth.	Mastoid breadth.	Depth of brain-case at middle.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
M. avellanarius.													
England: Thornhaugh, Northamptonshire	99.11.27.6*	♂	23·0	14·4	3·4	11·0	8·0	7·2	6·2	14·0	4·8	4·2	Teeth moderately worn.
Headley, Surrey	152787	♂	22·0	13·8	3·2	11·0	—	6·8	6·0	13·0	4·8	4·2	,, slightly worn.
Colchester, Essex	152788	♀	22·8	13·8	3·0	11·0	—	7·0	6·2	13·2	4·8	4·4	
Purchased alive in London		♀	21·8	13·2	3·4	11·0	—	7·0	6·0	13·0	4·8	4·4	
France: Guines, Pas-de-Calais	94.6.6.12	♂	21·0	13·0	3·0	10·6	7·8	7·0	5·8	12·0	4·4	4·4	,, ,,
,, ,, ,,	44.6.6.13	♀	21·0	13·0	3·4	10·6	7·8	7·2	5·6	12·6	4 8	4·6	,, ,,
Scientriers, Haute-Savoie	1128 Mottaz	♂	21·8	13·8	3·2	10·4	8·6	7·6	5·8	13·4	4·8	4 4	
Lucinges, Haute-Savoie	6.4.2.4		21·4	12·6	3·6	10·8	7·4	7·4	5·8	12·8	4·6	4·2	,, ,,
Montauban, Haute-Savoie	6.4.2.6		21·4	13·2	3·4	10·6	7·4	7·6	5·4	12·4	4·8	4·4	,, ,,
Germany: Niesky, Silesia	99.1.9.16	♂	20·4	12·8	3·6	10·0	7·2	6·0	5·4	12·0	4·8	4·6	,, ,,
Wolfshau, Riesengebirge, Silesia	112908	♂	21·4	13·0	3·2	—	8·0	6·8	5·6	12·2	4·8	4·4	,, not worn.
Switzerland: Geneva	1320 Mottaz	♂	22·4	13·4	3 6	10·8	—	7·0	6 2	13·0	4·8	4·6	
Lausanne, Vaud	172743		22·2	14·0	3·2	11·4	8·2	7·8	6·0	13·2	4·8	4·2	,, moderately worn.
Neuchatel	36336		22±	13·8	3·4	11·0	—	8·2	6·2	13·0	4·8	4·4	,, slightly worn.

Italy: Siena	152784	♀	22·4	14·0	3·6	10·4	8·2	7·4	6·0	13·0	5·0	4·6	Teeth slightly worn.
,,		♀	21·8	13·8	3·6	10·4	7·8	7·2	5·6	13·0	5·0	4·6	,, ,,
,,	11.1.2.112.	♀	23±	14·8	3·6	11·4	8·4	7·2	6·0	13·4	4·8	4·6	,, moderately worn.
Rome	152785	♀	21·6	13·4	3·2	10·8	7·4	7·4	5·6	13·0	4·8	4·6	,, slightly worn.
Austria-Hungary: Hatszeg, Hunyad	3.11.8.30	♀	21·4	13·2	3·4	11·0	7·4	7·0	5·8	12·8	5·0	4·6	,, ,,
M. pulcher.													
Italy: Perugia	98.10.2. 17†	♂	22·4	13·6	3·8	11·4	7·8	8·0	6·0	13·0	5·0	4·6	,, ,,
Monte Cimino, Rome	Genoa	♂	23·0	14·0	3·4	11·0	8·0	8·0	6·0	13·0	5·0	4·8	,, ,,
Sorrento	102981	♂	20·8	12·8	3·2	10·8	7·2	7·8	5·0	12·8	5·0	4·6	,, not worn.
,,	102982	♂	22·0	13·6	3·4	11·4	7·4	8·2	5·6	13 2	5·0	4·8	,, slightly worn.
,,	102985	♂	21·8	13·2	3·2	11·2	7·2	8·2	5·4	13·0	4·8	4·4	,, ,,
,,	102992	♂	21·4	13·2	3·4	11·0	7·2	—	5·4	12·8	4·8	4·2	,, ,,
,,	103004	♂	21·8	12·8	3·2	11·2	7·2	8·2	5·6	13·0	4·8	4·0	,, ,,
,,	103008	♂	22·0	13·2	3·2	11·0	7·2	8·8	6·0	13·0	4·8	4·6	,, ,,
,,	102974	♀	21·8	13·6	3·2	11·2	7·6	8·0	6·0	13·2	4·8	4·6	,, ,,
,,	102978	♀	21·8	13·4	3·2	11·2	7·2	8·0	5·6	12·8	4·8	4·6	,, ,,
,,	102980	♀	20·8	13·0	3·4	11·2	7·4	7·8	5·2	12·8	4·6	4·2	,, not worn.
,,	102984	♀	20·8	12·8	3·2	10·8	7·2	8·0	5·4	12·4	4·8	4·4	,, ,,
,,	102991	♀	21·6	12·8	3·2	11·4	7·2	8·2	5·8	12·8	4·6	4·2	,, slightly worn.
,,	102995	♀	21·2	13·0	3·2	11·2	7·2	8·2	5·4	12·8	4·6	4·2	,, not worn.
,,	102998	♀	21·2	13·6	3·2	11·2	7·4	7·8	5·6	12·6	4·8	4·4	,, slightly worn.
,,	102999	♀	22·0	—	3·2	11·0	7·6	8·2	6·0	13·0	4·6	4·2	,, ,,
,,	103001	♀	22·2	13·0	3·2	11·4	7·2	8·0	5·6	13·4	5·0	4·8	,, ,,
,,	103003	♀	22·0	13·6	3·4	11·4	7·8	8·4	5·8	12·8	5·0	4·4	,, ,,
,,	103006	♀	22·2	13·8	3·2	11·6	8·0	8·2	5·6	13·0	4·8	4·4	,, ,,
,,	103007	♀	22·4	14·0	3·4	11·6	7·6	8·2	5·8	13·2	4·8	4·6	,, ,,

* Type of *anglicus* Barrett-Hamilton. † Type.

♂.	Purchased in London.	G. Barrett-Hamilton (P).	11. 1. 2. 113.
♂.	Ratham, Sussex. (*W. Jeffrey.*)	E. R. Alston (P).	79. 9. 12. 2.
1.	Sussex.	E. Cavendish Taylor (P).	11. 1. 3. 403.
♂.	Honiton, Devonshire.	G. C. Shortridge (C & P).	11. 1. 3. 402.
1.	England.	Yarrell Collection.	56. 12. 10. 682.
♂, ♀.	Guines, Pas-de-Calais, France.	O. Thomas (C & P).	94. 6. 6. 12–13.
3 ♀, juv.	Manonville, Meurthe-et-Moselle. (*Lomont.*)	Lord Lilford (P).	11. 1. 1. 105–107.
2 ♂.	Cranves-Sales, Haute-Savoie, 1200 m. (*A. Robert.*)	O. Thomas (P).	5. 11. 18. 9-10.
♂, ♀.	Lucinges, Haute-Savoie. (*A. Robert.*)	O. Thomas (P).	6. 4. 2. 4–5.
♂.	Montauban, Haute-Savoie, 900 m. (*A. Robert.*)	O. Thomas (P).	6. 4. 7. 6.
1 st.	France. (*F. Petit.*)	E. Hargett (P).	97. 11. 25. 4.
♂.	Oberwald, Silesia, 400 m. Germany. (*W. Baer.*)	Lord Lilford (P).	99. 1. 9. 16.
♀ al.	Silesia.	Dr. Kaup (P).	
3.	Csallóköz-Somorja, Hungary.	Budapest Mus. (E).	94. 3. 1. 43–45.
1.	Zubereč, Hungary.	Budapest Mus. (E.)	94. 3. 1. 42.
♀ al.	Brassó, Hungary.	Prof. L. von Méhely (P).	95. 8. 12. 3.
1, 4 juv.	Hatszeg, Hunyad, Transylvania.	C. G. Danford (C).	3. 11. 8. 27–31.
♀, ♀ juv.	St. Gallen, Switzerland. (*E. H. Zollikofer.*)	O. Thomas (P).	2. 8. 4. 36–37.
♀.	Siena, Italy. (*Brogi.*)	G. Barrett-Hamilton (P).	11. 1. 2. 112.

MUSCARDINUS PULCHER Barrett-Hamilton.

1855. ? *Myoxus speciosus* Dehne, Allgem. deutsche Naturhist. Zeitung, neue Folge, I, p. 180, Tursi, Basilicata, Italy.

1898. *Muscardinus pulcher* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., II, p. 423, November, 1898, Perugia, Italy.

1900. *M[uscardinus] avellanarius speciosus* Barrett-Hamilton, Proc. Zool. Soc., London, p. 87.

1910. *Muscardinus avellanarius speciosus* Trouessart, Faune Mamm. d'Europe, p. 136.

Type locality.—Perugia, province of Perugia, Italy.

Geographical distribution.—At present known from Perugia, Rome, and the vicinity of Naples, Italy.

Diagnosis.—Like *Muscardinus avellanarius* but general colour brighter, the flanks nearly raw-sienna; white of throat extending upward as a conspicuous whitish stripe between eye and ear. Teeth somewhat larger than in *M. avellanarius*.

External characters.—In external form I can detect no difference between this species and *Muscardinus avellanarius;* mammæ 8, arranged as in the more northern animal.

Colour.—Upper parts including ears and entire tail very uniform yellowish buff, the exact shade perhaps best described as intermediate between the buff-yellow and raw-sienna of Ridgway, somewhat brighter on sides and flanks, faintly darker along middle of back; feet concolor with back, the toes suffused with whitish; underparts strongly contrasted pale cream-buff, the line of demarcation well-defined and conspicuous, the hairs slaty grey at base; chin and throat usually though not always with pure white area as in *M. avellanarius*, this area when present not forming noticeable contrast with rest of underparts.

Skull and teeth.—The skull and teeth do not differ appreciably from those of *Muscardinus avellanarius*, though the teeth are usually a trifle larger.

Measurements.—Type (adult male): head and body, 90; tail, 68; hind foot, 16; ear from meatus, 12. Adult male from Monte Cimino, Rome: head and body, 74; tail, 70; hind foot, 18·5. Average and extremes of ten males from Sorrento: head and body, 79·4 (71–86); tail, 65·3 (63–73); hind foot, 15·7 (15–17). Average and extremes of ten females from Sorrento: head and body, 79·9 (75–85); tail, 69·6 (62–73); hind foot, 15·9 (15–17). For cranial measurements see Table, p. 589.

Specimens examined.—Fifty-seven, from the following localities in Italy: Perugia, 1 (type); Monte Cimino, Rome, 1 (Genoa); Sorrento, 54 (U.S.N.M.); Palermo, Sicily, 1 (too young to be positively identified).

Remarks.—This species is well differentiated from *Muscardinus avellanarius* by its bright, light colour and by the white streak between ear and eye. It may eventually prove to be identical with the *Myoxus speciosus* of Dehne from the extreme south of Italy, but the description of the latter indicates a much darker more reddish animal. A single immature specimen (No. 8. 9. 28. 1) from Palermo, Sicily, too young and in too bad condition to be satisfactorily identified, is noticeably different from any of the numerous young individuals from Sorrento. In its "foxy" red colour it agrees with the description of Dehne's animal.

♂.	Perugia, Italy. (*Brogi.*)	Dr. E. Hamilton (P). (*Type* of species.)	98. 10. 2. 17.
♀.	Palermo, Sicily.	J. I. S. Whitaker (P).	8. 9. 28. 1.

Family MURIDÆ.

1821. *Muridæ* Gray, London Med. Repos., xv, p. 303, April 1, 1823.

Geographical distribution.—As in the order Rodentia.

Characters.—Anterior portion of zygomatic arch not formed chiefly by jugal; infraorbital foramen large, wider above than below, without accessory canal; jugal bone splint-like, supported by long zygomatic processes of maxillary and squamosal, not in contact with lachrymal anteriorly; mandible with angular

portion arising from under side of alveolus of incisor, its lower border not angulated; tibia and fibula joined; cheek-teeth never more than $\frac{3-3}{3\ 3}$, rooted or rootless, the crowns tuberculate or prismatic.

Remarks.—The cosmopolitan family *Muridæ* is more abundantly represented in genera, species and individuals than any other similar group of mammals. About a dozen sub-families are currently recognized, three of which occur in Europe.

KEY TO THE EUROPEAN SUB-FAMILIES OF *MURIDÆ*.

Molars prismatic, hypsodont or rootless, their crowns flat (Voles and Lemmings) ..... *Microtinæ*, p. 610.
Molars tuberculate, brachyodont, rooted.
Tubercles of maxillary molars arranged in two primary longitudinal series ..... *Cricetinæ*, p. 592.
Tubercles of maxillary molars arranged in three primary series..... *Murinæ*, p. 791.

SUB-FAMILY CRICETINÆ.

1866. *Cricetinæ* Murray, Geogr. Distrib. Mamm., p. 358.

Geographical distribution.—Entire American Continent; central region of Asia from eastern China west into south-eastern and central Europe; southern Africa.

Characters.—As in the sub-family *Murinæ*, but tubercles of maxillary teeth arranged in two primary longitudinal rows.

Remarks.—The sub-family *Cricetinæ*, though characteristically American, is represented in the Old World by about six genera, three of which occur in Europe.

KEY TO THE EUROPEAN GENERA OF *CRICETINÆ*.

General external and cranial characters essentially murine; fur with no special colour pattern (a narrow dark dorsal stripe in some oriental species); form of rostrum and brain-case about as in *Apodemus* (Dwarf Hamsters)..... *Cricetulus*, p. 593.
General external and cranial characters not murine, the body heavy and thick-set; fur with specialized colour-pattern of contrasted dark and light areas; rostrum broadened and brain-case narrowed, the parietal bones reduced in size (True Hamsters).
Anteorbital foramen with well-developed forward-projecting external plate; flattened area on dorsal surface of brain-case approximately parallel-sided; tail evident, longer than hind foot; mammæ 8 (Central Europe, west into Belgium and France) ..... *Cricetus*, p. 596.
Anteorbital foramen without forward-projecting external plate; flattened area on dorsal surface of brain-case truncate diamond-shaped; tail nearly concealed in the fur, shorter than hind foot; mammæ 16 (Eastern Europe, west into Roumania and Bulgaria) ..... *Mesocricetus*, p. 605.

Genus **CRICETULUS** Milne-Edwards.

1867. *Cricetulus* Milne-Edwards, Ann. des Sci. Nat., Paris, 5th ser., Zool., VII, p. 375.

Type species.—*Cricetulus griseus* Milne-Edwards.

Geographical distribution.—Central region of Asia from eastern China west through Asia Minor to the eastern portion of the Balkan Peninsula.

Characters.—Like *Cricetus*, but less highly modified; form murine; feet with normally developed tubercles; tail in European species well developed, slightly longer than hind foot; skull murine in appearance, with large (normal) interparietal and smooth brain-case and interorbital region, its general aspect much as in *Apodemus;* ectopterygoid fossa long and shallow; anteorbital foramen with evident external plate, some part of which is visible when skull is viewed from above; teeth as in *Cricetus*.

Remarks.—The genus *Cricetulus* contains about a dozen described species, whose distribution extends across the entire central portion of Asia. One occurs in the Balkan Peninsula, but the group is not otherwise represented in Europe west of Russia.

CRICETULUS ATTICUS Nehring.

1882. *Cricetus arenarius* Winge, Vidensk. Middel. fra den naturh. Foren. i Kjøbenhavn, 4th ser., III (1881), p. 31.

1902. *Cricetulus atticus* Nehring, Sitz.-Ber. Gesellsch. Naturforsch. Freunde, Berlin, p. 3, January, 1902.

1910. *Cricetulus atticus* Trouessart, Faune Mamm. d'Europe, p. 165.

Type locality.—Pentelikon, Attica, Greece.

Geographical distribution.—Greece; limits of range not known, but apparently confined to the eastern portion of the peninsula.

Diagnosis.—Similar to *Cricetulus phæus* of Asia Minor but smaller, the condylobasal length of skull about 25 mm. instead of about 27 mm., hind foot about 13·6 mm. instead of 15 mm. Skull with brain-case somewhat narrower than in *C. phæus*. In the only adult examined the underparts are pale buff instead of white. Recognizable among European murines by the short tail, pale greyish colour and large ears. (In the pallid members of the *Pitymys ibericus* group, which are of similar size and general appearance, the ears are nearly concealed in the fur.)

Colour.—Upper parts a light grey approaching the grey No. 10 of Ridgway but with a slight smoky cast, faintly tinged with ecru-drab on head and suffused with light buff on rump and buttocks, the hairs everywhere with dark tips, these inconspicuous except on crown and along middle of posterior half of back, where they produce a slight though evident clouding of

blackish. The individual hairs are slate-grey at base, those of the underfur with a sub-terminal band of grey No. 10 about 2 mm. in width and a minute blackish tip, the longer hairs blackish throughout. On rump and outer surface of hind legs the pale grey is replaced by light buff. Sides of body and outer surface of fore legs white, the line of demarcation well defined though not remarkably so, and extending along lower portion of cheeks and over base of whiskers to sides of muzzle, the lips thus entirely white and sharply defined against the narrow grey muzzle. A very narrow black eye-ring. Ears blackish, frosted with greyish white, not much contrasted with surrounding parts. Underparts in one specimen white, in another pale cream-buff rather sharply defined from the narrow white area along sides. Feet buffy white, including hairy portion of sole. Tail light cream-buff, the upper surface sprinkled with blackish hairs along median region.

Skull.—Apart from its much smaller size (approximately as in *Apodemus flavicollis*) the skull differs from that of *Cricetus cricetus* in its generally less modified, more murine appearance. Dorsal profile slightly and evenly convex throughout. Brain-case relatively narrower and rostrum relatively broader than in *Apodemus flavicollis* and *A. sylvaticus*, but these peculiarities not carried to the same extreme as in *Cricetus cricetus*. Brain-case distinctly longer than broad, slightly wider than deep, smoothly rounded off at sides, the occiput scarcely oblique, so that condyles are not visible when skull is viewed from above; the general form of brain-case essentially as in *Apodemus sylvaticus* but narrower and deeper, and with condyles more projecting. Interparietal about as in *A. sylvaticus*, but more convex in front and more nearly straight behind. Interorbital region about as wide as rostrum, its surface with faintly indicated median longitudinal groove, its edges slightly ridged. Rostrum a little less than half as wide as brain-case, distinctly more robust than in *Apodemus sylvaticus*, but without any special peculiarities of form. Nasals tapering gradually backward, squarely truncate posteriorly, much exceeded by nasal branches of premaxillaries. Zygomata slender, not very widely spreading, their middle portions approximately parallel. Auditory bullæ moderately large, essentially as in *Apodemus sylvaticus*. Mesopterygoid space parallel-sided, about three times as long as wide, its anterior termination nearly in line

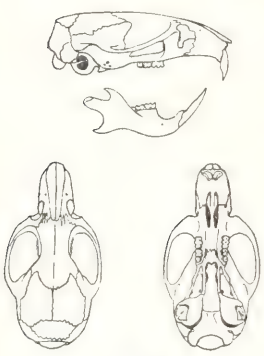

FIG. 117.
Cricetulus atticus. Nat. size.

CRANIAL MEASUREMENTS OF *CRICETULUS ATTICUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Breadth of brain-case.	Depth of brain-case at middle.	Nasal.	Diastema	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
Greece: Kephissia, near Athens	8. 10. 2. 47	♀	—	13·8	4·0	11·2	—	9·4	8·2	16·4	4·0	3·8	Teeth slightly worn.
,, ,,	8. 10. 2. 48	♀	25·2	13·4	4·0	11·0	8·0	9±	8·0	15·4	3·8	3·8	,, ,,
,, ,,	153382		—	13·4	3·8	10·8	—	9·2	8·0	15·4	3·8	4·0	,, moderately worn.

with posterior border of m^3, the hamulars not diverging posteriorly. Incisive foramina moderately long and narrow, much as in *Cricetus cricetus*, the width of both together about one-third length, their posterior border extending to within about 0·5 mm. of level of first molar. Mandible resembling that of *Cricetus cricetus* in the strongly bowed ramus and in the length and distinctness of the three main processes, the coronoid process larger and more approximating to size and form of angular process than in *Apodemus*. Outer surface of angular process distinctly convex laterally, not concave as in *Cricetus cricetus*.

Teeth.—Except for their much smaller size the teeth are essentially like those of *Cricetus cricetus* both in structure and in length of tooth-row relatively to diastema and to width of palate. Neither incisors nor molars show any tendency toward the peculiarities assumed in *Mesocricetus*.

Measurements.—External measurements of an adult female from Kephissia, near Athens: head and body, 87; tail, 22; hind foot, 16. For cranial measurements see Table, p. 595.

Specimens examined.—Three, all from the vicinity of Athens.

Remarks. Though nearly related to the *Cricetulus phæus* of Asia Minor, the Grecian animal appears to be sufficiently distinguished by its smaller size.

2 ♀. Athens, Greece. (*C. Mottaz.*) Hon. N. C. Rothschild (P). 8. 10. 2. 47–48.

Genus **CRICETUS** Leske.

1779. *Cricetus* Leske, Anfangsgrunde der Naturgesch., I, p. 168.
1799. *Hamster* Lacépède, Tabl. des divisions ordres et genres des Mamm., p. 10 (*Hamster nigricans* Lacépède = *Mus cricetus* Linnæus).
1859. *Cricetus* Blasius, Säugethiere Deutschlands, p. 305.
1873. *Heliomys* Gray, Ann. and Mag. Nat. Hist., 4th ser., XII, p. 417, November, 1873 (*H. jeudii* = *Cricetus cricetus*).

Type species.—*Mus cricetus* Linnæus (by tautonymy).

Geographical distribution.—Central Europe, from Belgium and northern France eastward into Russia and Asia Minor. Eastern limit of range not known.

Characters.—General form heavy and thick set, not murine; tail short but evident, slightly longer than hind foot; mammæ, 8; skull not murine in appearance, the interparietal much reduced, the brain-case with two conspicuous, nearly parallel ridges continued forward through interorbital region; occiput obliquely truncate; rostrum much more than half as broad as brain-case; ectopterygoid fossa short, deep, moderately pit-like; infraorbital foramen with well developed external plate; enamel pattern characterized by presence of noticeable supplemental median loops or islands in maxillary teeth.

Remarks.—The genus *Cricetus* is too easily recognizable among the European groups of rodents to require any special comparisons. As at present understood it is represented by a single species.

CRICETUS CRICETUS Linnæus.

(Synonymy under subspecies.)

Geographical distribution.—Central Europe from Belgium and northern France eastward into Russia and Asia Minor. Eastern limit of range unknown.

Diagnosis.—Essential characters as in the genus; size about as in a large house rat, length of hind foot in adult 30 to 35 mm., condylobasal length of skull 43 to 51 mm.; underparts entirely black in strong contrast with sides.

External characters.—Form robust and heavy, suggesting a house rat with short legs and rudimentary tail. Ear rather large, orbicular, extending about to eye when laid forward; a slightly developed ridge behind meatus; surface of ear well clothed both externally and internally with fine hairs. Muzzle-pad ill defined; inner border of nostril swollen and projecting, upper border notched; a narrow median groove between nostrils continuous below with broad naked and wrinkled median area on upper lip. Cheek-pouches large, extending backward to about level of ear, their openings entirely within the loosely spreading lips. Feet moderately large, the claws stout, slightly curved, those on front feet slightly exceeding those on hind feet in size. Front foot with inner digit rudimentary, tubercular, with minute flattened nail; second digit slightly longer than fifth and a little exceeded by fourth, this in turn by third, the contrasts in length not very noticeable; palm with five well developed tubercles, of which the two posterior are largest, and that at base of second toe smallest; relatively to size of palm the tubercles are large, leaving little space between them. Hind foot with all five toes well developed, the innermost extending to base of second, the outermost slightly longer, the three middle digits sub-equal and longest; tubercles six, all well developed and of about equal size though rather small, not arranged in pairs, the postero-internal lying distinctly behind postero-external; surface of sole hairy from heel to posterior tubercles; median area nearly to anterior tubercles distinctly pubescent. Tail short but well developed, extending about to tip of outstretched hind feet; annulations ill-defined and irregular, concealed by the thick covering of short hairs. Mammæ: $p\ 2-2$, $i\ 2-2=8$.

Colour.—Upper parts a uniform light yellowish brown or brownish buff, the exact shade usually something between the wood-brown and ochraceous-buff of Ridgway though occasionally with a russet or yellowish tinge, particularly on flanks, rump

and anal region; median dorsal region faintly clouded by a sprinkling of black-tipped hairs; side of muzzle, side of face around and below eye, and a similar area around and below ear tinged with tawny or dull ochraceous in rather noticeable contrast with crown and back; ear tawny edged with white, a conspicuous clear buff tuft just below and behind meatus; underparts (except chin and anal region), inner surface of hind leg and entire fore leg black, somewhat dulled by the slaty under colour which appears at surface when hairs are worn or disarranged; between the black and brown areas lie the following markings in clear, light buff: (1) an area including front of muzzle, upper lip and chin and extending backward to level of ear in front of which it rises as a narrow band nearly separating anterior and posterior tawny areas, (2) a large roundish area on side of neck just in front of fore leg, (3) a similar area extending backward from axilla and separated from that on neck by a dusky upward prolongation of black of leg, and (4) a small spot (about equal to that at base of ear) at front of thigh, this last sometimes obsolete or absent; feet buffy white; tail dull yellowish brown, sometimes whitening at tip.

Skull.—The skull is robust and heavy, about the size of that of a large house rat. Dorsal profile nearly flat, but sloping gradually and inconspicuously forward from lachrymal region and abruptly though not very conspicuously convex over anterior third of nasals; ventral profile essentially straight from behind incisors to lower surface of auditory bulla, nowhere parallel with dorsal profile, but nowhere conspicuously contrasted with it. Brain-case roundish or somewhat diamond-shaped in general outline when viewed from above (when of latter form with ends truncate at lambdal and interorbital regions); most of the surface of brain-case is formed by the broad temporal areas of muscle attachment, between which lies the narrow flat median region continued backward from interorbital trough, narrower anteriorly than posteriorly, and bounded posteriorly by that portion of lambdoid crest which lies along posterior border of small, triangular or crescentic interparietal. No true sagittal crest, though flat median area of brain-case becomes narrow and crest-like in old individuals. Lambdal crest well developed, with strong median concavity and a lateral convexity at each side. Occipital region so obliquely truncate that the condyles and entire upper surface of supraoccipital, from foramen magnum to lambdal region, are visible when skull is viewed from above. Occiput broadly arched when viewed from behind, a little flattened above and at the sides, its height slightly more than half mastoid width; mastoid processes thick and short, their lower border slightly above level of lower lip of foramen magnum; paroccipital processes short but well developed, extending a little below lip of foramen magnum. Base of brain-case with no special features, the basioccipital sloping

noticeably upward posteriorly, its anterior half with median groove, the backward extension of that occupying most of basisphenoid. Auditory bulla rather large, evenly inflated, not in contact with paroccipital process, its greatest diameter oblique; meatus large, without tube or lip; a distinct depression near middle of bulla parallel with meatus; greatest diameter of bulla about three times anterior width of basioccipital. Interorbital region narrow, with distinct median furrow and raised edges, the margin slightly but evidently angled posteriorly;

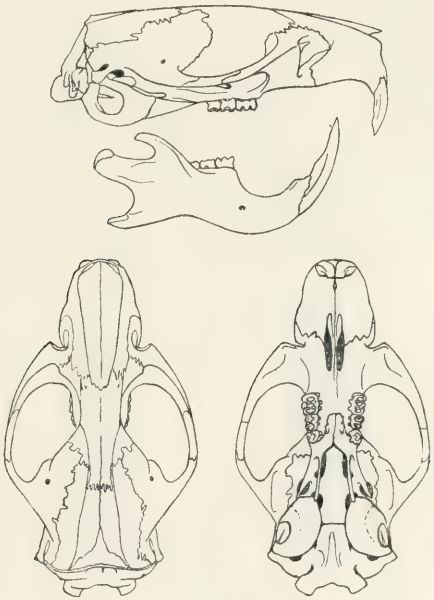

FIG. 118.
Cricetus cricetus. Nat. size.

behind angles the ridges and furrow pass gradually into the narrowest anterior portion of flat median area of brain-case. Zygoma heavy but without special features, very gradually spreading, so that greatest zygomatic breadth is at front of glenoid region; anteorbital foramen wide above, narrow and slit-like below, the well developed external plate of canal plainly visible when skull is viewed from above, its anterior border nearly perpendicular. Rostrum very heavy, its greatest width at about middle, decidedly wider than interorbital region and more than half as wide as brain-case; width at middle decidedly

greater than depth at same region, extreme anterior portion much narrower; nasals gradually narrowing from before backward, their posterior extremity bluntly pointed, slightly exceeded by nasal branches of premaxillaries. Incisive foramina long and narrow, parallel-sided, the width of the two together a little more than one-half length; anteriorly they extend to within about 4 mm. of alveoli of incisors, posteriorly to within about 3 mm. of aveoli of molars. Bony palate with no special features; a faintly indicated median ridge continuous with septum between incisive foramina; mesopterygoid fossa about three times as long as wide, its broadly rounded anterior extremity scarcely extending to level of alveolus of m^3, the plate-like, ill-defined hamulars in contact with auditory bullæ; ectopterygoids well developed, lying, except at their anterior extremity, at a higher (more dorsal) level than the pterygoids. Mandible slender, the ramus strongly curved; coronoid process rising decidedly above condyle, conspicuously curved backward; angular process long, curved upward and outward, its upper margin with a well developed thickening or supplemental outer plate.

Teeth.—Upper incisor with root extending to infraorbital foramen, at front of which it produces a noticable swelling, the

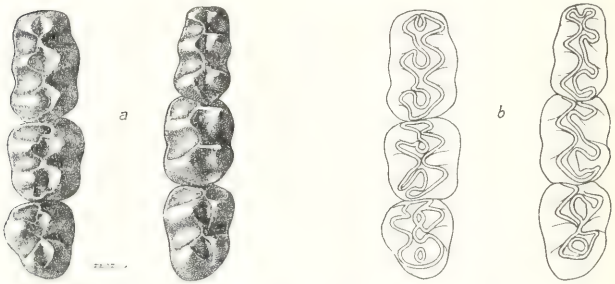

FIG. 119.

Cricetus cricetus. Teeth × 5. *a*, unworn; *b*, slightly worn.

shaft slightly and somewhat obliquely compressed, the antero-posterior diameter a little exceeding transverse diameter, the anterior face broadly rounded, decidedly wider than posterior face, that of the two teeth essentially in line with each other; cutting edge sloping upward toward the middle, the two edges together forming a broad but evident angle; lower incisor with root extending nearly to base of coronoid process and forming an evident tubercle on outer side of mandible slightly above level of grinding surface of molars; shaft oval in cross section, the inner side somewhat flattened, the antero-posterior diameter about double transverse diameter, the anterior and posterior faces

narrowly and equally rounded. Molar rows about half as long as diastema in fully adult skulls, relatively longer in immature individuals; anteriorly the rows diverge noticeably, owing to somewhat oblique position of m^1, so that length of tooth-row is only equal to greatest width of palate and alveolus of one side. Anterior upper molar with four or sometimes five roots and six tubercles, its crown about as large as m^2 and first pair of tubercles of m^3; the two anterior slightly smaller than the others; outer tubercles in line with each other and parallel to main axis of crown, antero-internal tubercle somewhat displaced outward so that the line of the three inner tubercles curves outward in front, adding to the oblique appearance of the tooth; a deep pit in median line between each pair of tubercles, the pits at a certain stage of wear assuming the form of enamel islands, or of re-entrant loops extending obliquely backward from base of outer tubercles and later disappearing; at the stage in which the pits have become loops the crown of the tooth has an enamel pattern consisting of six triangles arranged in opposite pairs but nearly closed by the backward extension of the outer re-entrant angles; at the later stage when the last trace of the pits has disappeared, the bases of the triangles open broadly into each other, forming three transverse loops nearly divided by the equal external and internal re-entrant angles. Second upper molar 4-rooted, the crown with four tubercles resembling the posterior four tubercles of first; anterior border of crown with narrow transverse ridge, best developed on outer side though scarcely rising above level of extreme base of anterior tubercles. Third upper molar 3-rooted, slightly more than half as large as second, the two anterior tubercles normal in form though slightly reduced in size, the two posterior tubercles small and confluent, the outer more reduced than the inner, but traces of all the elements of the tooth present; anterior ridge well developed on outer side of middle but obsolete or absent on inner side. Mandibular molars resembling the corresponding upper teeth in general form and structure, but m_1 relatively smaller and m_3 relatively larger, the tubercles slightly but evidently alternating, the inner more anterior in position than the outer, and deepest re-entrant angles on inner side instead of on outer side, the inner extremities of the angles at no stage so distinctly isolated as pits. First lower molar at all ages with six nearly closed triangles, distorted in unworn teeth by the cusp-like elevation of their outer walls; anterior pair of cusps noticeably smaller than the others but essentially in line. Second and third lower molars like posterior four cusps of first, the crown of m_3 nearly as large as that of m_2, its posterior pair of cusps very little reduced; anterior border of each tooth with low but evident ridge on outer side.

Remarks.—*Cricetus cricetus* differs conspicuously from all other European rodents in its unusual colour pattern with underparts entirely black. Four local forms have been described.

Three of these occur west of Russia. Their status is at present by no means clearly understood.

KEY TO THE EUROPEAN RACES OF *CRICETUS CRICETUS*.

Skull large, the condylobasal length about 50 mm.
(Central Germany eastward into Hungary)..... *C. c. cricetus*, p. 602.
Skull moderate, the condylobasal length about 45 mm.
Occipital portion of brain-case high, its truncation moderately oblique as in typical race (Belgium and western Germany)..... *C. c. canescens*, p. 603.
Occipital portion of brain-case low, its truncation unusually oblique (Roumania)..... *C. c. nehringi*, p. 605.

Cricetus cricetus cricetus Linnæus.

1758. [*Mus*] *cricetus* Linnæus, Syst. Nat., I, 10th ed., p. 60, Germany.
1792. *M*[*us*] *Cricetus germanicus* Kerr, Anim. King., p. 243 (*Cricetus germanicus* in Syst. Catal., inserted between pp. 32 and 33) Germany.
1799. *Hamster nigricans* Lacépède, Tabl. des division, ordres et genres des Mamm., p. 10 (Renaming of *Mus cricetus*).
1801. *M*[*us*] *c*[*ricetus*] *fulvus* Bechstein, Gemeinn. Naturgesch. Deutschlands, I, 2nd ed., p. 1010 (Thüringen, Germany).
1803. *Cricetus vulgaris* Geoffroy, Catal. Mammif. du Mus. Nat. d'Hist. Nat., p. 196, northern and eastern Europe (Renaming of *Mus cricetus*).
1811. *Cricetus frumentarius* Pallas, Zoogr. Rosso.-Asiat., p. 161 (Renaming of *Mus cricetus*).
1857. *Cricetus frumentarius* Blasius, Säugethiere Deutschlands, p. 306.
1867. [*Cricetus vulgaris*] *varius* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LVI, pt. I, p. 98 (Europe).
1867. [*Cricetus vulgarus*] *albus* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LVI, pt. I, p. 98 (Germany).
1867. [*Cricetus vulgaris*] *niger* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LVI, pt. I, p. 98 (Austria, Hungary, Germany).
1873. *Heliomys jeudii* Gray, Ann. and Mag. Nat. Hist., 4th ser., XII, p. 417, November, 1873 (locality unknown).
1894. *Cricetus cricetus* Dahl, Die Heimat, IV, p. 130, June, 1894.
1906. *Cr*[*icetus*] *vulgaris niger* Simroth, Biol. Centralblatt, XXVI, p. 337, June 1, 1906. Valley of the Saale, Germany.
1910. *Cricetus cricetus* and *C. cricetus niger* Trouessart, Faune Mamm. d'Europe, p. 159.

Type locality.—Germany.

Geographical distribution.—Locally distributed through central Germany. Exact limits of distribution not known, and apparently undergoing rapid change.*

Diagnosis.—Skull large and heavy, the condylobasal length

* For detailed account of local distribution in Germany see Nehring, Wiegmann's Archiv für Naturgeschichte, 1904, pp. 15–32, pl. III, and Sitz.-Ber. Gesellsch. Naturforsch. Freunde, Berlin, 1899, pp. 3–4.

about 50 mm. ; brain-case deep posteriorly, the truncation of occipital region moderately oblique, the angle of the slope as referred to plain of base of brain-case about 70°.

Measurements.—Adult male from the neighbourhood of Magdeburg, Germany : head and body, 260 ; tail, 60 ; hind foot (dry), 36 ; ear from meatus about 27. A second adult male from the same locality : hind foot (dry), 36. For cranial measurements see Table, p. 604.

Specimens examined.—Nineteen, from the following localities :—
History unknown, 1 skull (type of *Heliomys jeudii* Gray).
GERMANY : No exact locality, 1 ; Ingelheim, Rheinhessen, 6 ; Oberlausitz, Saxony, 1 ; Lotzen, Saxony, 1 (U.S.N.M.) ; near Magdeburg, Saxony, 6 ; Saxony, no exact locality, 1 (U.S.N.M.) ; Strassburg, 1 (Lataste).
AUSTRIA-HUNGARY : Molna Szecsőd, Hungary, 1 (U.S.N.M.), an immature individual, perhaps not true *cricetus*.

1.	Germany. (*Möschler.*)	E. R. Alston (P).	79. 9. 25. 35.
6 ♂.	Ingelheim, Rheinhessen.	C. Hilgert (C).	8. 11. 2. 38–43.
♂.	Oberlausitz, Saxony.	Dr. E. Hamilton (P).	97. 12. 4. 33.
3, 1 juv.	Magdeburg.	Dr. W. Wolterstorff (P).	92. 12. 1. 24–27.
skull.	——	Lidth de Jeude Collection. (*Type* of *Heliomys jeudii* Gray.)	67. 4. 12. 314.

CRICETUS CRICETUS CANESCENS Nehring.

1899. *Cricetus vulgaris* var. *canescens* Nehring, Sitz.-Ber., Gesellsch. Naturforsch. Freunde, Berlin, p. 1.
1910. *Cricetus cricetus canescens* Trouessart, Faune Mamm. d'Europe, p. 160.

Type locality.—Near Fexhe-Slins, banks of the Maas, Belgium.

Geographical distribution.—Eastern Belgium and north-western Germany ; probably north-eastern France also.*

Diagnosis.—Similar to *C. cricetus cricetus*, but skull noticeably smaller, its condylobasal length about 45 mm. ; form of brain-case as in the typical race.

Measurements.—External measurements of two adult males from Tirlemont, Liége, Belgium : head and body, 212 and 218 ; tail, 50 and 47 ; hind foot, 35 and 35 (dry, 33 and 33·4) ; ear, 32 and 28. For cranial measurements see Table, p. 604.

Specimens examined.—Four, from the following localities :—
BELGIUM : Tirlemont, Liége, 3.
GERMANY : Brunswick, 1 (Field).

Remarks.—The status of this race is not satisfactory. The Belgian specimens which I have seen show none of the

* I have seen no French specimens, but the form will probably prove to be *canescens*. For account of recent changes in distribution in France see Trouessart, Faune Mamm. d'Europe, p. 159.

CRANIAL MEASUREMENTS OF *CRICETUS CRICETUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Occipital breadth.	Occipital depth.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
C. cricetus cricetus.													
Germany: Lotzen, Saxony .	120928		49·2	28·4	6·2	19·2	12·8	18·8	16·6	32·6	7·8	7·6	Teeth moderately worn.
Magdeburg . .	92. 12. 1. 24		—	30·0	6·0	21·2	—	19·0	15·6	32·8	8·0	7·8	,, ,,
,, . .	92. 12. 1. 25		—	—	6·2	—	—	18·4	16·0	31·4	8·0	7·8	,, slightly worn.
,, . .	153383	♂	51·4	—	6·4	21·8	13·8	20·0	16·4	33·2	8·2	7·8	,, moderately worn.
,, . .	153384	♂	51±	29·2	6·0	—	—	19·6	16·6	32·6	8·0	7·6	,, much worn.
Ingelheim, Rhein-hessen . .	8. 11. 2. 38	♂	51·0	30·6	6·2	22·0	14·0	20·0	16·2	32·2	8·0	8·0	,, moderately worn.
,, ,,	8. 11. 2. 39	♂	49·8	30·2	6·2	20·8	13·2	20·4	16·0	31·8	7·8	8·0	,, ,,
,, ,,	8. 11 2. 40	♂	50·0	30·2	6·2	21·2	13·6	18·8	15·8	31·0	8·0	8·0	,, much worn.
,, ,,	8. 11. 2. 41	♂	50·0	30·2	6·4	22·0	13·2	19·8	17·0	33·0	8·0	8·0	,, ,,
,, ,,	8. 11. 2. 42	♂	49·6	31·0	6·6	21·2	13·0	19·6	15·8	31·8	8·0	8·0	,, moderately worn.
,, ,,	8. 11. 2. 43	♂	51·0	30·8	6·6	21·0	13·4	21·0	16·0	32·8	8·0	8·2	,, much worn.
Strassburg . .	2258 Lataste	♂	49·6	31·0	6·6	21·0	13·6	19·0	16·0	32·8	7·8	7·8	,, ,,
Locality not known . .	67. 4. 12. 314*		47·0	27·0	6·2	19·0	12·0	17·0	15·4	30·2	7·8	8·0	,, slightly worn.
C. cricetus canescens.													
Belgium: Tirlemont, Liége .	8. 11. 23. 1	♂	44·0	26·4	6·2	19·6	12·2	17·2	13·8	29·2	7·6	8·0	,, moderately worn.
,, ,,	8. 11. 23. 2	♂	45·2	27·8	6·4	19·8	12·6	17·6	14·2	30·0	7·4	8·0	,, ,,
Germany: Brunswick . .	6422 Field	♀	45·6	27±	6·0	18·8	11·8	18·2	14·8	30·6	7·4	8·0	,, much worn.
C. cricetus nehringi.													
Roumania: Bucharest .	122100		43·6	25·8	6·2	18·0	11·0	16·4	13·8	28·0	7·8	7·6	,, moderately worn.

* Type of *Heliomys jeudii* Gray.

peculiarities in colour described by Nehring, but agree perfectly in this respect with those from central Germany. The small size of their skulls, however, is too pronounced a character to permit the name *canescens* to be placed in the synonymy of true *cricetus*.

2 ♂, 1 al. Tirlemont, Belgium. Rev. L. Warnau (P). 8. 11. 23. 1-3.

Cricetus cricetus nehringi Matschie.

1901. *Cricetus nehringi* Matschie, Sitz.-Ber., Gesellsch. Naturforsch. Freunde, Berlin, p. 232.
1910. *Cricetus cricetus nehringi* Trouessart, Faune Mamm. d'Europe, p. 160.

Type locality.—Described from specimens from Slobosia, Cernavoda, and Barza, Roumania. The first may be assumed to be the type locality.

Geographical distribution.—Known only from a few localities in Roumania.

Diagnosis.—Externally as in *C. cricetus cricetus*, but tail apparently shorter; skull small, as in *C. c. canescens*, the brain-case noticeably depressed posteriorly and truncation of occipital region more oblique than in the other races, the angle of the slope as referred to plain of base of brain-case about 60°.

Colour.—The colour does not appear to differ appreciably from that of true *C. cricetus*, though in the one adult examined the light thigh spot is barely indicated by a few scattered whitish hairs.

Measurements.—External measurements of adult (from well-made skin): head and body, 230; tail, 28; hind foot, 30·6; ear from meatus, about 22. For cranial measurements see Table opposite.

Specimen examined.—An adult from Bucharest, Roumania (U.S.N.M.).

Genus **MESOCRICETUS** Nehring.

1898. *Mesocricetus* Nehring, Zool. Anzeiger, XXI, p. 494, September 5, 1898 (Sub-genus of *Cricetus*).
1898. *Semicricetus* Nehring, Zool. Anzeiger, XXI, p. 494, footnote (Alternative for *Mesocricetus*).
1898. *Mediocricetus* Nehring, Zool. Anzeiger, XXI, p. 494, footnote (Alternative for *Mesocricetus*).
1900. *Mesocricetus* Satunin, Zool. Anzeiger, XXIII, p. 301, May 28, 1900 (genus).

Type species.—*Cricetus nigricans* Brandt.

Geographical distribution.—Caspian region and Asia Minor, west into eastern Roumania and Bulgaria. Limits of range not known.

Diagnosis.—Externally as in *Cricetus*, but tail shorter than

hind foot, nearly concealed in fur, and mammæ 14 to 16 * instead of 8; skull resembling that of *Cricetus* in general features, but anteorbital foramen without external plate, and flattened area on dorsal surface of brain-case broad, its outline somewhat truncate-diamond shaped; ectopterygoid fossa short, deep, and conspicuously pit-like; teeth not essentially different from those of *Cricetus*, though showing a higher degree of specialization.

Remarks.—This well characterized genus contains six described forms, one of which occurs in eastern Europe. It is the most aberrant of the Old World group of *Cricetinæ*.

MESOCRICETUS NEWTONI Nehring.

1898. *Cricetus newtoni* Nehring, Zool. Anzeiger, XXI, p. 329, May 16, 1898.
1898. *Cricetus* (*Mesocricetus*) *newtoni* Nehring, Wiegmann's Archiv für Naturgeschichte, 1898, I, p. 386, December, 1898.
1900. *M[esocricetus] newtoni* Satunin, Zool. Anzeiger, XXIII, p. 301, May 28, 1900.
1910. *Mesocricetus newtoni* Trouessart, Faune Mamm. d'Europe, p. 162.

Type locality.—Schumla, eastern Bulgaria.

Geographical distribution.—Eastern portions of Bulgaria and Roumania. Exact limits of range not known.

Diagnosis.—Size smaller than in *Cricetus cricetus* (hind foot less than 20 mm., condylobasal length of skull less than 40 mm.); black of underparts not extending behind fore legs; a blackish area on crown continued backward as median line to between shoulders; an oblique black stripe from side of shoulder to lower margin of cheek.

External characters.—General form as in *Cricetus cricetus*, but tail nearly concealed in fur, its surface without trace of scales or annulations, and noticeably more hairy below than above. Ear as in *Cricetus*, extending to eye when laid forward. Feet as in *Cricetus*, but pads on sole more crowded, the postero-internal and postero-external at same level, and the others showing a distinct tendency to become arranged in pairs. Sole almost naked throughout, the portion behind tubercles slightly pubescent. Mammæ: 7—7 or 8—8 (in skin No. 122097, U.S.N.M., apparently $p\,4-4$, $i\,4-4$).

Colour.—Upper parts a light drab brown, perhaps most nearly the broccoli-brown of Ridgway, but paler and with a slight wood-brown cast, especially along middle of back, everywhere finely and inconspicuously sprinkled with blackish hairs. Underparts cream-buff, clearer and more yellowish along sides of body, neck and cheeks, duller and somewhat obscured by the smoke-grey under colour on belly; region from interramia to between fore legs and covering antero-internal surface of leg nearly to wrist blackish brown, not so dark as the corresponding

* See Nehring, Sitz.-Ber. Gesellsch. Naturforsch. Freunde, Berlin, 1901, p. 155.

region in *Cricetus cricetus;* chin dull whitish; upper lip cream-buff. Face, muzzle and most of region between ear and eye like back but paler; roundish area covering most of cheek below eye and extending forward to base of whiskers strongly tinged with dull ochraceous; minute hairs on eyelids black; behind and somewhat below cheek spot is a clear cream-buff area continuous with that of side of neck; ear silvery grey in noticeable contrast with surrounding parts; region behind ear strongly tinged with buff; crown between ears and slightly in front of them blackish,* this area continued backward as a fairly well defined median stripe about 3 mm. in width to a little behind shoulders; a better defined black stripe about 6 mm. wide extends obliquely downward and forward from front of shoulder to about angle of jaw; this stripe thrown into strong relief by clear cream-buff area lying between it and the downward extension of somewhat darkened body colour toward upper portion of leg; feet and tail buffy white. Immature individuals are lighter and less tinged with wood-brown above, and less buffy on sides; the dark markings essentially as in the adults.

Skull.—Apart from its smaller size the skull bears a general likeness to that of *Cricetus cricetus;* profiles essentially as in the

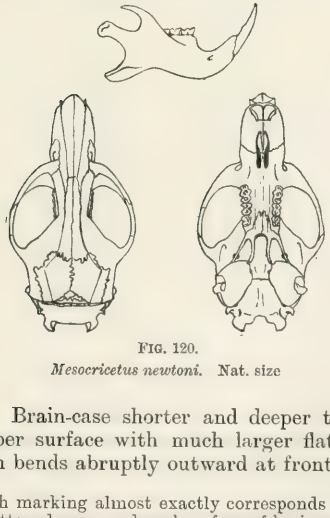

FIG. 120.
Mesocricetus newtoni. Nat. size

larger animal. Brain-case shorter and deeper than in *Cricetus cricetus,* its upper surface with much larger flattened area, the border of which bends abruptly outward at front of parietal and

* This blackish marking almost exactly corresponds in size, form and position to the flattened area on dorsal surface of brain-case.

continues nearly parallel with outer margin of the bone to lambdal suture, the two borders together producing a diamond-shaped figure. Interparietal with antero-posterior diameter relatively greater and tranverse diameter relatively less than in *Cricetus cricetus*. Interorbital region much narrower than rostrum, with high lateral ridges and well marked median groove. Zygoma not peculiar in general form, gradually spreading so that greatest zygomatic breadth is at glenoid level. Anterior base of zygoma peculiar in the complete absence of the forwardly extending plate forming outer wall of infraorbital foramen in *Cricetus*, so that when viewed from above the anterior margin forms an unbroken curve to maxillo-premaxillary suture. The absence of the outer plate causes the foramen to assume an oval outline somewhat flattened on inner side. Rostrum not tapering anteriorly, the width of the region immediately in front of infraorbital foramina not increased by any evident swellings over roots of incisors. Incisive foramina relatively shorter and broader than in *Cricetus cricetus*, the outer margins slightly but evidently spreading in front of suture, the posterior margins extending to level of posterior margins of infraorbital foramina. Palate relatively narrower than in *Cricetus cricetus*, but with no special peculiarities of structure. Mandible with coronoid process relatively longer than in *Cricetus cricetus*, its apex almost overhanging articular surface.

Teeth.—Upper incisor not producing any noticeable swelling at front of infraorbital foramen, the shaft narrower internally than externally, its transverse diameter and greatest antero-posterior diameter equal, its anterior face nearly flat, sloping conspicuously inward, so that those of the two teeth come together at a noticeable angle; cutting edge very oblique. Lower incisor with shaft flattened in front and on inner side, the outer and posterior borders evenly rounded, the antero-posterior diameter scarcely exceeding greatest transverse diameter. Molar rows about two-thirds as long as diastema; anteriorly the rows diverge so slightly and the palate is so narrow that length of tooth-row is distinctly greater than width of palate, including both alveoli. Form, relative size, and general structure of molars both above and below as in *Cricetus cricetus*, but backward prolongation of outer re-entrant angles in upper teeth, apparently at all stages isolated as pits or islands, and width of re-entrant angles in lower teeth greater relatively to area of tubercles.

Measurements.—Head and body about 180; tail about 12 (well-made skins); hind foot in three adults, 19 mm.; ear from meatus about 15. For cranial measurements see Table opposite.

Specimens examined.—Nine, from the following localities:—
Roumania: Malcoci, Dobrudscha, 7 (B.M. and U.S.N.M.).
Bulgaria: Melschka, near Rustchuk, 2 (Andersen).

Remarks.—Apart from the generic characters, its peculiar

CRANIAL MEASUREMENTS OF *MESOCRICETUS NEWTONI*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Occipital breadth.	Occipital depth.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
Roumania: Malcoci, Dobrudscha	122098	♂	33·6	19±	4·2	13·2	8·2	13·0	10·0	22·0	6·6	6·2	Teeth moderately worn.
,, ,,	122097	♀	36·8	21±	3·8	14·2	9·4	14·8	10·8	23·6	6·6	6·4	,, much worn.
,, ,,	122095		33·8	18·4	4·0	13·2	8·6	12·8	10·0	21·8	6·4	6·2	,, moderately worn.
,, ,,	122096		32·8	18·2	4·0	13·2	8·8	12·2	9·8	21·8	6·4	6·4	,, ,,

colour pattern will at once distinguish this animal from all other European rodents.

1.	Malcoci, Dobrudscha, Roumania.	Purchased (Prulière) (F).	86. 4. 2. 5.
1.	Rustchuk, Bulgaria.	Dr. Knud Andersen (F).	6. 5. 17. 1.

Sub-Family MICROTINÆ.

1906. *Microtinæ* Miller, North Amer. Fauna, No. 12, p. 8.

Geographical distribution.—Northern portion of both hemispheres, south to Mexico, northern India, and the Mediterranean coast of Europe

Characters.—Murine rodents with definitely prismatic, hypsodont or rootless, flat-crowned molars.

Remarks.—The sub-family *Microtinæ* contains about thirty groups, genera or sub-genera, the status of which is still imperfectly understood. These fall naturally into three main sub-divisions, the *Lemmi*, characterized by the shortness of the lower incisor, the root of which remains on the lingual side of the molar alveoli, the *Microti*, containing the true voles, and the *Ellobii*, the last highly modified for underground life. The *Lemmi* and *Microti* are represented in western Europe, the first by two living genera, the second by four. Fossil and sub-fossil remains of members of the sub-family are found throughout this region, some of them representing genera now extinct.

KEY TO THE EUROPEAN GENERA OF *MICROTINÆ*.

Root of lower incisor lying entirely on lingual side of molar teeth (*Lemmi*).
- General form vole-like; feet slender (normal); palms and soles with well developed functional (normal) tubercles ..... *Myopus*, p. 611.
- General form short and heavy; feet broad, the metapodials shortened and ungual phalanges lengthened; palms and soles with rudimentary, non-functional tubercles concealed by a dense growth of stiffened hairs ..... *Lemmus*, p. 614.

Root of lower incisor extending to outer side of molar teeth (*Microti*).
- Bony palate terminating posteriorly in a thin-edged shelf; molars rooted in adult ..... *Evotomys*, p. 623.
- Bony palate terminating posteriorly in a sloping median ridge and two lateral pits.
  - Sole with six well developed tubercles; mammæ, 8. *Microtus*, p. 658.
    - Third upper molar with three re-entrant angles on inner side ..... *Microtus*, p. 659.
    - Third upper molar with two re-entrant angles on inner side ..... *Chionomys*, p. 712.
  - Sole with five well developed tubercles; mammæ, 8 or 4.
    - First lower molar with first outer and first inner triangle communicating; mammæ, 4; general form modified for underground life... *Pitymys*, p. 752.
    - First lower molar with first outer and first inner triangle not communicating; mammæ, 8; general form modified for aquatic (rarely subterranean) life ..... *Arvicola*, p. 723.

Genus **MYOPUS** Miller.

1910. *Myopus* Miller, Smithsonian Miscell. Coll., LII, p. 497, January 12, 1910.

Type species.—*Myodes schisticolor* Lilljeborg.

Geographical distribution.—Southern Norway and central Sweden; eastward into Finland and perhaps much further. Limits of range not known.

Characters.—Skull and teeth as in *Lemmus*; general form vole-like, though tail rather short; feet slender, the palm and sole with fully developed, functional tubercles and no unusual growth of hair; metacarpals of third and fourth fingers slightly longer than phalanges; ungual phalanges of manus normal, much shorter than first and second phalanges combined, the claws not enlarged; ear well developed though small, with distinct meatal valve.

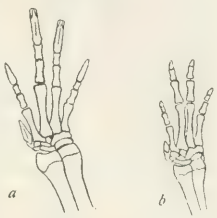

FIG. 121.

Skeleton of fore foot of *Lemmus* (*a*) and *Myopus* (*b*).

Remarks.—The genus *Myopus* is characterized by the combination of the skull and teeth of *Lemmus* with the general body-form and foot structure of the voles. It is, therefore, less specialized than the other Old World lemmings, representing a stage of development equivalent to that of the American *Synaptomys*. Only one species is known.

MYOPUS SCHISTICOLOR Lilljeborg.

1844. *Myodes schisticolor* Lilljeborg, Öfversigt af Kongl. Vetenskaps-Akad. Förhandl., Stockholm, I, p. 33, March 20, 1844.

1910. *Lemmus schisticolor* Trouessart, Faune Mamm. d'Europe, p. 199.

1911. *Myopus schisticolor* Collett, Norges Pattedyr, Hefte 3, p. 130 March, 1911.

Type locality.—Near Lillehammer at north end of Mjösen, Gudbrandsdal, Norway.

Geographical distribution.—Fir forests of southern Norway and central Sweden; eastward into Finland and perhaps much further.* Exact limits of range not known.

Diagnosis.—General characters as in the genus; size essentially as in *Microtus agrestis* (head and body about 100 mm.; condylobasal length of skull, 25 mm.); tail short, extending barely as far as outstretched hind foot; colour slaty grey with reddish brown dorsal patch.

* Recorded by Middendorff from Ajan, west coast of the Okhotsk Sea (Sibirische Reise, II, Säugethiere, Vögel und Amphibien, p. 108, 1853). The validity of this record questioned by Allen (Bull. Amer. Mus. Nat. Hist., XIX, pp. 153, 154, March 31, 1903).

External characters.—Form vole-like, slightly more robust than in *Microtus agrestis*, the legs not shortened and feet not enlarged as in *Lemmus lemmus*. Head rather large, the anterior portion blunt; ear rounded, well developed, but nearly concealed in the fur, reaching to within about 2 mm. of eye when laid forward, the meatus with a distinct though not very high, broadly triangular valve, both surfaces of ear thickly covered with rather short hairs, a noticeable tuft of longer hairs at outer base of meatal valve; muzzle pad slightly developed, the upper and inner margins of nostrils strongly projecting; upper lip with deep median cleft. Feet slender, strictly vole-like in form and relative size, the claws on hind feet slightly larger and less compressed than those on fore feet. Fore foot with the inner digit essentially as in *Lemmus lemmus*, its strongly compressed, strap-shaped nail extending to base of second digit; outer digit as long as second and a little less than half as long as the subequal second and third; pads four, well developed, essentially as in the smaller voles, except that that at base of thumb is absent, and postero-external is relatively larger and more elongated, its extremity reaching nearly to level of tip of thumb-nail when the two are approximated; surface of palm between pads granular-tuberculate, naked with a few scattered minute hairs. Hind foot at least as slender as that of *Evotomys glareolus*, its five tubercles relatively larger and more crowded, occupying much more than half the surface of the region in which they occur, its digits with no special peculiarities of size or form; sole densely hairy behind pads, naked between them except for a sprinkling of very fine hairs, the naked surface conspicuously granular-tuberculate; main tubercles sub-equal in size and essentially alike in form except that the two hindermost are somewhat smaller and more terete than the others, these two nearly in contact, the outer slightly in front of the inner. Tail short, but not unusually robust, densely covered with hairs that nearly conceal the narrow, ill-defined annulations; pencil slender, about one-half as long as vertebræ. Mammæ: $p\ 2-2$; $i\ 2-2 = 8$.

Colour.—Except for the dorsal patch the entire animal is a uniform dark grey approaching the slate-colour of Ridgway, the upper parts with a slight steely effect due to the metallic, almost silvery, appearance of the tips of the shorter hairs, and a less evident dark "lining" produced by the longer wholly black hairs; a broad, rather ill-defined area on middle of back, extending from shoulders to within about 15 mm. of base of tail, a reddish brown intermediate between russet and rufous. Feet and tail slaty black, the hairs on under side of latter with a strong silvery gloss.

Skull and teeth.—Apart from their noticeably smaller size the skull and teeth do not differ essentially from those of *Lemmus lemmus*. The general outline of the skull when viewed from

CRANIAL MEASUREMENTS OF *MYOPUS SCHISTICOLOR*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Mastoid breadth.	Depth of brain-case at middle.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
Norway: Eidsvold .	84. 10. 31. 2		-	16·6	3·4	—	—	6·8	7·2	15·8	7·6	6·4	Ridges joined, high.
Hurdalen .	84. 10. 31. 3		24·0	15·0	3·2±	12·0	7·2	6·6	6·8	15·4	7·4	6·8	,, low.
Fluberg .	154555		24±	15·0	3·2	—	—	6·8	6·8	15·2	7·2	6·6	,, moderate.

above is somewhat less broadened than in the larger animal, and the emargination of posterior border of palate extends relatively further forward: to level of last prism of m^2, instead of to level of first prism of m^3, anteorbital foramen with slit-like lower portion so shortened as to be practically absent.

In the few specimens examined the inner border of cutting edge of upper incisor is less folded backward than in *Lemmus lemmus*, and the outer re-entrant angle of m_3 is occasionally so little developed that it fails to cut off a distinct triangle from outer extremity of second transverse loop, a condition, rarely, if ever, found in *L. lemmus*.

Measurements.—Adult (old) female from Eidsvold, Norway (in alcohol): head and body, 95; tail, 19; hind foot, 15·4; ear from meatus, 10. For cranial measurements see Table, p. 613.

Specimens examined.—Fifteen, from the following localities:—
Norway: Hurdalen, Gudbrandsdal, 1; Fluberg, Hadeland, 2 (B.M. and U.S.N.M.); Eidsvold, Akershus, 2; Heen, Christiania, 1.
Sweden: Nerike, Wermland, 2 (U.S.N.M.); Upsala, 1 (U.S.N.M.); Medelpad, W. Norrland, 4; no exact locality, 1 (U.S.N.M.); Dalarne, 1.

1.	Hurdalen, Gudbrandsdal, Norway.	Dr. R. Collett (P).	84. 10. 31. 3.
♂ juv.	Fluberg, Hadeland.	Christiania Museum (E).	93. 3. 1. 18.
2 ♀ al.	Eidsvold, Akershus.	Dr. R. Collett (P).	84. 10. 31. 1–2.
♂ juv.	Heen, Christiania.	Christiania Museum (E).	93. 3. 1. 19.
2 ♂ juv. 2 ♀ juv.	Medelpad, W. Norrland, Sweden.	Lord Lilford (P).	11. 1. 1. 111–114.
1 al.	Dalarne.	Stockholm Museum (E).	90. 8. 1. 18.

Genus **LEMMUS** Link.

1795. *Lemmus* Link. Zool. Beyträge, 1, pt. II, p. 75. Type by tautonymy *Mus lemmus* Linnæus.
1811. *Myodes* Pallas, Zoogr. Rosso-Asiat., 1, p. 172 (part).
1877. *Myodes* Coues, Monogr. N. Amer. Rodentia, p. 237.
1896. *Lemmus* Miller, N. Amer. Fauna, No. 12, p. 36, July 23, 1896.

Type species.—*Mus lemmus* Linnæus.

Geographical distribution.—Arctic region of both hemispheres; in Europe south to southern Norway.

Characters.—General form noticeably heavier and more robust than in the voles; legs and tail short; feet broad, the palm and sole covered with a dense growth of stiffened hairs, under which are concealed the rudimentary, functionless tubercles; metacarples of third and fourth fingers much shorter than phalanges; ungual phalanges of manus greatly enlarged, slightly longer than first and second phalanges combined, the claws enlarged but simple; ear well developed though small,

without meatal valve; skull very broad and low, the zygoma conspicuously expanded at middle, the mesopterygoid space short but continued forward over (under when skull is examined from below) posterior margin of palate; lower incisor with root lying entirely on lingual side of cheek-teeth; molars rootless, the enamel pattern characterized by great depth of outer re-entrant angles in maxillary teeth, the points of these angles extending practically to inner margin of crown; m^3 with four transverse loops and no closed triangles; m_3 with three transverse loops and one closed triangle.

Remarks. Except for the primitive condition of the lower incisors characteristic of the lemmings as a group, the members of the genus *Lemmus* are probably more specialized than those of any of the related genera. In *Dicrostonyx** the ear is more reduced and the claws reach their maximum of development; but the skull and molars are distinctly more generalized in form and structure. Two species of *Lemmus* are now known to inhabit the Old World, while several other forms have been described from North America. Only one occurs in Europe, west of Russia.

LEMMUS LEMMUS Linnæus.

1758. [*Mus*] *lemmus* Linnæus, Syst. Nat., I, 10th ed., p. 59 (Sweden).
1808. *L*[*emmus*] *lemmus* Tiedemann, Zoologie, I, p. 474.
1820. *Lemmus borealis* Nilsson, Skand. Faun., I, p. 185 (Substitute for *lemmus*).
1822. *Lemmus norwegicus* Desmarest, Mammalogie, pt. II, p. 287 (Norway).
1895. *Myodes lemmus* Collett, Christiania Vetenskabs, Selskabs Forhandlinger, 1895, No. 3, p. 3.

* While no living member of the genus *Dicrostonyx* is now known to occur in Europe west of the Gulf of Finland, sub-fossil remains are found in many parts of central and western Europe associated with those of *Lemmus*. Such specimens of the two genera may be distinguished as follows:—

Lemmus.—Skull very broad and low; zygomata greatly expanded at middle; temporal ridges early uniting to form a knife-like crest in interorbital region; postorbital process shelf-like; auditory bullæ very large, their substance conspicuously spongy; a large foramen below and behind alveolus of m_3; tooth-rows noticeably converging anteriorly; upper molars with outer re-entrant angles conspicuously deeper than inner; m^2, m^3, and m_3 with one or more transverse loops in addition to the terminal loop.

Dicrostonyx.—Skull moderately broad, not specially depressed; zygomata not greatly expanded at middle; temporal ridges never uniting, the interorbital region with a noticeable longitudinal furrow; postorbital process peg-like; auditory bullæ not unusually large, their substance scarcely spongy; no noticeable foramen below and behind alveolus of m_3; tooth-rows nearly parallel; upper molars with outer and inner re-entrant angles approximately equal; m^2, m^3 and m_3 without transverse loops in addition to the terminal loop. Externally *Dicrostonyx* is distinguished from *Lemmus* by the reduction of the ear to a low rim, the absence of any well developed nail on thumb, and the bifurcate form of claws on third and fourth fingers in winter.

1896. *L[emmus] lemmus* Miller, North American Fauna, No. 12, p. 37, July 23, 1896.

1910. *Lemmus lemmus* Trouessart, Faune Mamm. d'Europe, p. 198.

Type locality.—Mountains of Lappmark, Sweden.

Geographical distribution.—Northern Scandinavia and Finland, east to the White Sea, south in the mountains of Norway to Langfjeld, Christiansand,* and in Sweden to northern Wermland.† During seasons of abnormal increase the animals wander to the extreme south of Norway.

Diagnosis. General character as in the genus; size medium (head and body about 135 to 145 mm.; tail, 12 to 14 mm.; hind foot, 17 to 20 mm.; condylobasal length of skull, 29 to 32 mm.); colour yellowish brown, the head, neck and shoulders with a conspicuous black mantle.

External characters.—Form robust, the head large and very broad, appearing to be set directly on the shoulders, the legs short and muscular, the tail very short and thick. Head broader than deep, its greatest width nearly equal to that of body at middle, the muzzle bluntly rounded; ear short, concealed in the fur, extending barely to eye when laid forward, its outline evenly rounded, the meatus without trace of valve; eyes rather small, their distance apart about equal to that from inner canthus to nostril; muzzle pad obscure, the nostrils opening close to broad short groove which divides narrow upper lip, their inner and lower margins slightly projecting. Front leg short, very muscular, the foot broad, with short, robust digits, the innermost of which is very short, strongly compressed, and serving merely as a base for the conspicuous strap-shaped nail 4 mm. in length by 3 mm. wide; the third is longest, and the fourth, second and fifth are successively shorter; palm covered with a dense mass of stiffened hairs about 3 mm. in length, the tubercles represented by a rudimentary pad at base of the two longest fingers; claws simple but large and robust, about 5 mm. or more in length (frequently exceeding length of fingers), sharply pointed or blunt according to condition of wear. Hind foot broad, with short, strong digits, the three median of which are sub-equal and longest, the innermost shortest and outermost intermediate; claws strong, simple, about 4 mm. in length; sole densely hairy like palm, the rudimentary, functionless tubercles completely hidden; on cutting away the hair four minute pads may be detected, one at the base of the inner toe, one at the base of second, the third between bases of third and fourth toes and the fourth at base of fifth. Tail short, extending about to middle of outstretched hind foot, its form somewhat club-shaped, the diameter at base distinctly less than that just below tip; hairs rather short at base, nearly as long as vertebræ at tip where they

* Collett, Norges Pattedyr, p. 138, 1911.

† Lilljeborg, Sveriges och Norges Ryggradsdjur, I, p. 326, 1874.

form a dense pencil ; annulations irregular but rather well defined, about 0·5 mm. wide. Fur full and soft, the hairs of general body-covering about 10 mm. in length, those of back and rump increasing rather abruptly to 20 or 30 mm. Mammæ : $p\ 2-2$, $i\ 2-2 = 8$.

Colour.—Underparts and sides buff, paler (in some specimens whitish) on throat and chin, yellower on cheeks and sides of neck, darker and more ochraceous on belly ; upper parts black anteriorly, ochraceous posteriorly, the exact tint of the latter varying between the ochraceous, raw-sienna, and tawny of Ridgway, the slate-grey under colour appearing irregularly at surface, especially at sides of longer haired area, where there is usually an ill-defined blackish stripe, especially noticeable in summer ; a narrow ill-defined black median stripe may usually be traced backward from posterior border of black area to middle of back or to rump ; black area everywhere sharply defined, its posterior border a short distance behind shoulders, its lateral border extending almost horizontally along a line beginning at nostril and passing just below eye and ear (leaving entire upper lip buff) to side of shoulder, where it curves upward ; an ochraceous buffy line, about 3 mm. wide, extends backward from eye to region between ears where it abruptly widens to a squarish patch, the two patches frequently uniting in median line to form a conspicuous occipital area 20 mm. wide by 10 mm. long ; extreme point of muzzle above naked pad pale buff ; some trace of a buffy median line usually present along middle of face ; ear blackish, the hairs immediately surrounding it mostly tipped or annulated with buffy ; feet light buffy with a silvery gloss, the digits tinged with hair-brown ; claws light horn-colour ; tail light buff, the upper surface usually sprinkled with blackish hairs. There is not much seasonal change in colour. Winter specimens tend to be more yellowish, summer specimens more brown ; in the latter the median dark stripe on middle of back reaches its extreme of distinctness, and the dark border to ochraceous dorsal area is often rather conspicuous. Newly born young are essentially similar to the adults, though the buff and ochraceous are dull ; owing to the shortness of the fur the colour pattern is very sharply defined.

Skull.—In general form the skull is broad and depressed, with rather slender rostrum and unusually heavy, abruptly spreading zygomata. Dorsal profile essentially horizontal from lambdoid region to anterior base of zygomata, the rostrum bent abruptly downward at an angle of about 35° ; ventral profile concave immediately behind incisors, then essentially parallel to dorsal surface, but curving abruptly upward posteriorly from middle of bulla to base of paroccipital process. Brain-case broadly lyrate in outline when viewed from above, owing to the noticeable constriction just in front of mastoid region, and the abrupt posterior expansion over widest portion of bullæ ;

postorbital process forming a narrow but evident shelf, extending from base of zygoma to beyond middle of posterior border of orbit; interparietal large, sub-quadrate, its antero-posterior diameter about two-thirds transverse diameter; lambdoid crest rather high and distinct laterally, but scarcely noticeable along posterior margin of interparietal; occiput abruptly truncate, nearly perpendicular below, slightly rounded-off above, the condyles and paroccipital processes just visible in dorsal view; seen from behind the occiput is low and broad, its width noticeably more than twice height above foramen magnum; paroccipital processes projecting more backward and outward than downward, their lowest point slightly below level of condyles; floor of brain-case with no special features, the basioccipital with a moderately defined median longitudinal ridge, its width along basal suture

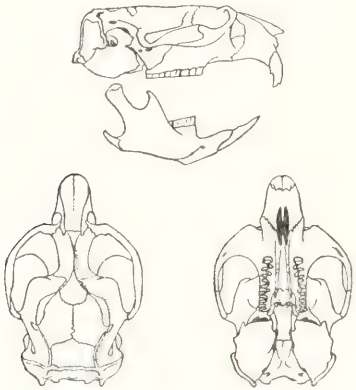

FIG. 122.
Lemmus lemmus. Nat. size.

contained about 2½ times in median length; auditory bulla large but not very highly inflated, the interior nearly filled by a dense mass of spongy tissue, the ventral border about on level with cutting surface of molars, the size chiefly due to extension forward into ectopterygoid fossa nearly to level of posterior border of molar, width of bulla at level of meatus greater than width between outer surfaces of occipital condyles. Interorbital region narrow, cylindrical, scarcely as wide as rostrum, its dorsal surface concave between zygomatic roots, posteriorly with well marked ridges, which early unite to form a short, trenchant median crest. Zygoma very heavy anteriorly, broadly expanded at middle, abruptly slender and weak posteriorly; anteorbital foramen rather small, very narrow below, the plate forming its outer border slightly developed at base, its anterior border

vertical. Nasal simple, squarely truncate posteriorly at level of middle of zygomatic root, scarcely or not exceeded by the very slender nasal branches of premaxillaries. Incisive foramina long and very narrow, extending from about 1·5 mm. behind incissors to within about 1 mm. of level of molar alveoli. Palate about as wide as alveolus anteriorly, about twice as wide posteriorly; lateral grooves moderately well marked; posterior emargination extending nearly to level of front of m^3, its median spine blunt and short, but evident; pterygoids short, the hamulars heavy, curved outward posteriorly, the mesopterygoid space extending over posterior margin of palate. Mandible rather slender, but with conspicuously developed ridges for muscular attachment; posterior portion with a peculiar thin and sunken aspect, due partly to the absence of the incisor root from this region, and partly to the high masseter ridge and the conspicuous expansion outward of under surface of large angular process; articular process very slender and weak, much compressed; coronoid process broad at base, but narrowing rapidly to a delicate backward-curved point, the extremity of which in uninjured specimens reaches to level of base of articular facet; dental foramen near posterior margin of base of articular process, and on level with rim of alveolus; a slightly larger foramen, 1·5 mm. below and in front of dental foramen at posterior extremity of depression between outer alveolar wall and inner surface of ascending portion of mandible.

Teeth.—As compared with those of the typical voles, such as the members of the genera *Microtus* and *Arvicola*, the incisors are weaker and the molars heavier relatively to size of skull. The molars are further peculiar in the unusual width of the posterior tooth, which causes the cutting surface of the tooth-row to be almost parallel-sided instead of backwardly tapering; main axes of upper tooth-rows not essentially parallel as in the voles, but so converging anteriorly that if prolonged they would meet slightly in front of incisors. Upper incisors rather long and distinctly curved, not projecting forward, the root producing a slight swelling at front of anteorbital foramen; cross-section of shaft approximately semicircular, the flattened border directed inward, the anterior margin pale yellow in colour, slightly wider than posterior margin, the greatest transverse diameter a little behind middle; enamel covering anterior fourth of inner surface and extending to slightly beyond middle of outer surface; cutting surface of tooth deeply and conspicuously hollowed, its anterior margin bent sharply backward internally, following course of enamel, its posterior border forming a distinct

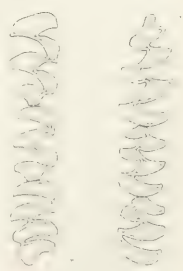

FIG. 123.
Lemmus lemmus.
Teeth. × 5.

cusp-like projection on margin of central hollow, slightly above level of alveolus. Lower incisor more slender than upper tooth, its root extending to level of middle of m_3, its cross section essentially like that of upper incisor, but greatest transverse diameter in front of middle, and postero-external border distinctly flattened. First upper molar with an anterior transverse loop and four alternating closed triangles. The anterior loop somewhat triangular in form, owing to the deep re-entrant angle at its postero-internal border, the two closed triangles on lingual side of tooth noticeably smaller than the others, their main axis oblique instead of transverse, the salient angles tending to be truncate at their extremites; re-entrant angles four, all well developed and regularly alternating, two on each side of tooth. Second upper molar with crescentic anterior loop isolated by the very deep first outer re-entrant angle, a second loop essentially like first loop of m^1, and two closed triangles like the posterior pair in m^1 but slightly smaller; re-entrant angles three, all well developed and regularly alternating, two outer and one inner. Third upper molar with four loops extending completely across crown, the first crescentic like that of m^2, and similarly isolated by a single deep inner re-entrant angle, the second slightly narrower and bounded posteriorly by two exactly opposed re-entrant angles, the third similar to second but bounded posteriorly by a deep inner re-entrant angle and a very shallow exactly opposed outer angle, the terminal loop with transverse diameter slightly less than in the others, its posterior border with a shallow but noticeable concavity on inner side; re-entrant angles five, the first (outer) extending across crown, the second and third opposite and equal, the last two opposite and unequal, the inner extending nearly across crown, the outer very shallow. First lower molar with a narrow anterior loop thrown into a projecting point in front by the presence of a broad concavity on both outer and inner border; closed triangles three, essentially alike in form, but that on outer side noticeably smaller than the others; posterior loop similar to anterior loop of m^2 and m^3 but narrower; re-entrant angles five, all well developed and alternating, two outer and three inner (in some specimens one or both of the concavities on anterior loop might be counted as a small additional re-entrant angle). Second lower molar with a posterior loop like that of first, and four triangles, the first pair of which are smaller than the second pair; re-entrant angles four, all well developed, two on each side. Third lower molar consisting essentially of three tranverse loops isolated by the two re-entrant angles extending across crown from inner side, but second loop with postero-external border indented by a small but well developed re-entrant angle which cuts off outer extremity of loop as a closed triangle not quite equal in size to the outer closed triangle of m^1 and m^2; terminal loop similar in form to that of the other mandibular teeth, but slightly larger and less narrowed.

Measurements.—External measurements of two males and a female from Hjerkin, Dovre, Norway: head and body, 145, 129 and 145; tail, 15, 18 and 17; hind foot, 17, 17 and 18. Two males and a female from Jemtland, Sweden: head and body, 129, 134 and 130; tail, 18, 19 and 19; hind foot, 17, 18 and 18. For cranial measurements see Table, p. 622.

Specimens examined.—Seventy-seven, from the following localities:—
NORWAY: Trondhjem, 4; Röraas, Trondhjem, 5 (B.M. and U.S.N.M.); Brekkebygden, Trondhjem, 5; Hyllingen, Trondhjem, 3; Vigel Fjeld, Trondhjem, 4; Kvikne, Trondhjem, 2; Dovre Mts., 1 (U.S.N.M.); Hjerkin, Dovre, 5; Fille Fjeld, 3; Mölmen, northern Gudbrandsdal, 2; Tönsæt, Hedemarken, 1 (U.S.N.M.); Stor Elvedal, Hedemarken, 1 (U.S.N.M.); Lillehammer, Kristiansamt, 1 (U.S.N.M.); Gudbrandsdal, no exact locality, 1 (U.S.N.M.); Gausdal, Gudbrandsdal, 3 (U.S.N.M.); no exact locality, 9.
SWEDEN: Jemtland, 27 (B.M. and U.S.N.M.).

2.	Röraas, Trondhjem, Norway.	Christiania Museum (E).	93. 3. 1. 16–17.
3 ♂, 5 ♀.	Trondhjem.	G. Barrett-Hamilton (P).	8. 10. 5. 1–8.
2 ♂.	Kvikne, Trondhjem.	G. Barrett-Hamilton (P).	8. 10. 5. 12–13.
♂, 2 ♀.	Hjerkin, Dovre. (*J. L. Bonhote.*)	G. Barrett-Hamilton (P).	8. 10. 5. 9–11.
♂, ♀, ♂ juv.	Fille Fjeld. (*Brown and Alston.*)	E. R. Alston (P).	79. 9. 25. 63–65.
2 ♂.	Mölmen, Gudbrandsdal.	R. J. Cuninghame (C & P).	98. 5. 2. 10–11.
2.	Norway.	F. Du Cane Godman (P).	73. 3. 21. 2–3.
7 al.	Norway.	Prof. Owen (P).	56. 7. 9. 9–15.
5 ♂, 4 ♀.	Jemtland, Sweden. (*G. Kolthoff.*)	Lord Lilford (P).	8. 10. 19. 19–27.

NOTE ON *LEMMUS LEMMUS CRASSIDENS* NEHRING.

On March 3, 1896, Major G. E. H. Barrett-Hamilton exhibited before the Zoological Society of London "several fresh-looking skeletons of the Norway Lemming (*Myodes lemmus*), obtained by Dr. H. Gadow in caves near Athouguia, in Portugal." Commenting on these specimens he said: "Early in the year 1895 Dr. H. Gadow handed me for examination some skeletal remains of a species of small mammal, which, on a first inspection, appeared to be those of some species of Vole—*Microtus*. Thinking the remains were those of Voles I put them aside for a time; but later on, when I had an opportunity of examining them more carefully I found, to my surprise, that they consisted of some skeletons and detached bones of the Norway Lemming, *Myodes lemmus*. When first received by me the remains consisted of a good many fragments and single bones, and of two almost complete skeletons. These latter were completely enveloped in the original skin, which had become so dried and hardened that in order to enable myself to examine the skeletons I had to get it removed. The whole appearance of the specimens was so fresh that, unaware as I was of their true character, I had the dried skin, which enveloped them like mummies, removed, so that, I

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Mastoid breadth.	Depth of brain-case at middle.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
L. lemmus lemmus.													
Norway: Mölmen . .	85. 5. 2. 10	♂	30·0	18·8	3·8	11·8	7·8	8·8	9·8	20·4	8·2	7·8	Ridges joined, low.
Brekkebygden .	8. 10. 5. 2	♂	31·8	20·2	4·0	15·2	8·4	9·2	10·4	21·0	8·2	7·4	,, ,, ,,
Tönsæt, Hede-marken .	154541	♀	31·4	20·4	3·8	15·0	8·0	8·8	9·4	21·0	8·2	8·2	,, ,, moderate.
Hjerkin, Dovre	8. 10. 5. 9	♂	32·2	21·4	4·0	15·2	8·4	9·2	10·4	21·0	8·6	8·2	,, ,, high.
,, ,,	154542		31·6	20·4	4·0	15·2	8·6	9·2	10·4	20·8	8·4	8·0	,, ,, moderate.
,, ,,	8. 10. 5. 10	♀	29·8	20·0	3·6	14·0	7·8	8·4	10·0	20·4	8·2	7·8	,, ,, low.
Sweden: Jemtland .	8. 10. 19. 25	♂	30·6	20·0	4·0	14·4	8·2	9·0	10·0	20·2	8·2	7·8	,, ,, moderate.
,, . .	153134	♂	29·4	18·4	4·0	—	8·2	8·0	9·2	19·6	8·2	7·6	,, nearly joined.
,, . .	8. 10. 19. 23	♂	30·8	20·4	4·0	14·4	8·0	8·6	10·0	20·2	8·2	7·8	,, joined, low.
,, . .	153138	♂	31·8	20·0	4·0	15·0	8·2	9·0	10·4	20·2	8·6	8·2	,, ,, moderate.
,, . .	153133	♂	31·2	20·2	4·0	15·2	8·2	9·0	10·2	20·4	8·2	7·8	,, ,, ,,
,, . .	8. 10. 19. 24	♂	30·6	20·8	4·0	15·0	8·0	8·8	10·0	20·8	8·0	7·8	,, ,, low.
,, . .	153136	♀	31·2	21·0	4·0	15·0	8·0	9·0	10·0	21·2	8·4	8·0	,, ,, ,,
,, . .	8. 10. 19. 26	♀	29·2	19·2	4·2	13·8	7·8	8·2	9·6	19·2	8·0	7·8	,, ,, ,,
,, . .	8. 10. 19. 27	♀	29·4	20·0	4·0	14·4	8·2	8·0	9·6	19·6	8·0	7·6	,, ,, ,,
L. lemmus "crassidens."													
Portugal ? . . .	866*e*, 2 L*		29·2	19·0	4·2	14·0	7·8	8·2	9·6	19·8	8·6	8·0	,, ,, ,,
,, . . .	,,		30·0	—	4·0	15·2	8·2	—	9·4	—	8·4	—	,, ,, ,,
,, . . .	,,		29·8	20·0	3·8	13·8	7·6	8·2	9·6	20·0	8·2	7·6	,, ,, ,,
,, . . .	,, 1 L		29·4	18·8	3·8	14·2	7·8	8·4	9·6	20·2	8·4	7·8	,, ,, ,,
,, . . .	,,		—	—	—	—	—	—	10·2	—	8·8	—	,, ?

* Type.—Cambridge.

regret to say, not one of these most interesting specimens has been preserved in the condition in which I received it. Some of the vertebræ, however, are still connected together by the dried remains of the ligaments. This, and the whiteness and excellent preservation of the bones, will show how easy it was to be deceived as to their nature, and to come to the belief that they were of recent origin and perhaps unimportant...The present skulls resemble those of recent Lemmings very closely indeed...I cannot find any characters sufficiently important to enable me to separate the two specifically" (Proc. Zool. Soc. London, 1896, pp. 304–305). Three years later, however, they were examined by Nehring and distinguished from the Norway Lemming as *Myodes lemmus crassidens*, principally on account of their relatively large molar teeth and certain fancied peculiarities in the form of the coronoid process of the mandible (Wiegmann's Archiv für Naturgeschichte, LVI, I, p. 174, June, 1899).

Through the courtesy of the authorities of the Cambridge Museum I have been able to compare the original *crassidens* material with a series of seventeen skulls of true *lemmus* in the British Museum. As submitted to me this material consisted of three perfect skulls (including the type), one skull without lower jaw, one rostral portion of skull together with palate and maxillary teeth, two complete lower jaws, and one single mandible, the whole representing not less than six nor more than eight individuals. The specimens are well preserved, with most of the teeth in place, and have all the appearance of fresh material. In size and form the skulls show no peculiarities. No old individuals are represented; the measurements therefore do not attain the maximum (see Table opposite). The coronoid processes are broken at the tip, giving them the short, blunt appearance noted by Nehring. In one complete skull and the odd mandible the teeth are of the same size as in ordinary average specimens of true *lemmus;* in the type they equal those of the largest-toothed Norwegian specimen in the series (from Mölmen, northern Gudbrandsdal); in one complete skull, one skull without lower jaw, and one odd lower jaw they are slightly above the maximum of *lemmus;* while in the fragmentary skull and two odd jaws they are decidedly above the maximum. That is, assuming that eight individuals are represented, three are perfectly matched among the seventeen Scandinavian specimens, while five are not. This makes it impossible at present to synonymize *crassidens* with *lemmus*. On the other hand, it seems almost equally impossible to believe that the specimens came from Portugal, and that some confusion of material did not take place during the period when Dr. Gadow's Athouguia mummies, regarded as "unimportant," were "put aside."

Genus **EVOTOMYS** Coues.

1839. *Myodes* de Sélys-Longchamps, Études de Micromamm., p. 87 (section).

1840. *Hypudæus* Keyserling and Blasius, Wirbelth. Europas, p. 34 (subgenus: type *Mus glareolus* Schreber), not *Hypudæus* Illiger, 1811.

1858. *Hypudæus* Blasius, Säugethiere Deutschlands, p. 336 (sub-genus).

1874. *Evotomys* Coues, Proc. Acad. Nat. Sci. Philadelphia, p. 186 (genus, type *Mus rutilus* Pallas).

1896. *Evotomys* Miller, North Amer. Fauna, No. 12, p. 42, July 23, 1896.

1900. *Crascomys* Miller, Proc. Washington Acad. Sci., II, p. 87 (sub-genus of *Evotomys*: type *Hypudæus rufocanus* Sundevall).

1907. *Crascomys* Thomas, Proc. Zool. Soc., London, 1906, p. 863, April 11, 1907 (genus).

Type species.—*Mus rutilus* Pallas.

Geographical distribution.—Boreal portions of both hemispheres; south in Europe to the Pyrenees and the mountains of southern Italy.

Characters.—Bony palate terminating posteriorly in a simple, thin-edged, horizontal shelf; lower incisor with root extending to outer side of molar-roots, but not rising above level of cutting surface of molars and not forming any protuberance on outer surface of ascending portion of mandible; molars with two well developed prongs or roots in adult, the crown disappearing by wear in extreme old age; pattern of enamel folding characterized, as compared with that of other European voles, by a tendency toward roundness or bluntness of the salient angles; external form without special peculiarities.

Remarks.—In the shortness of the mandibular incisor root, a peculiarity which it shares with the American *Phenacomys*, the genus *Evotomys* stands nearer to the *Lemmi* than any of the other European members of the sub-family. Its rooted molars must also be regarded as a primitive character, since the same peculiarity is found in many of the related fossil genera. About fifty forms are now recognized in the genus, thirteen of which occur in northern Europe. These have recently been grouped in three sub-genera,* two of which have even been regarded as genera; but the discovery of intermediate species makes this course seem no longer tenable.†

KEY TO THE EUROPEAN FORMS OF *EVOTOMYS*.

Tail densely haired, the pencil at least one-fourth as long as vertebræ (Arctic Europe)..... *E. rutilus*, p. 646.

Tail moderately haired, the pencil much less than one-fourth as long as vertebræ.

Skull of adult massive, its size large, the condylo-basal length frequently more than 26 mm. (25 to 27·6 mm.); teeth heavy, length of tooth-rows 6 mm. or more.

Red of dorsal area conspicuously contrasted with grey of sides; ear noticeably over-topping fur; m^3 normally without third re-entrant angle on inner side (Northern and mountainous portions of Scandinavia) *E. rufocanus*, p. 648.

* True *Evotomys*, *Crascomys* Miller, and *Phaulomys* Thomas (Ann. and Mag. Nat. Hist., 7th ser., xv, p. 493, May, 1905. Type *Evotomys smithii* Thomas, from Kobe, Hondo, Japan).

† For observations on the lack of distinctions between *Phaulomys* and *Crascomys* see Anderson, Ann. and Mag. Nat. Hist., 8th ser., IV, p. 318, October, 1909. For notes on the status of *Crascomys* see account of *Evotomys rufocanus*, below, p. 658.

Red of dorsal area not conspicuously contrasted with yellowish brown of sides; ear scarcely overtopping fur; m^3 normally with third re-entrant angle on inner side (Channel Islands) ..... *E. cæsarius*, p. 645.

Skull of adult delicate or slightly massive, its size small or moderate, the condylobasal length rarely 26 mm. (21·5 to 26·2 mm.); teeth light or moderately heavy, the length of tooth-rows rarely 6 mm. (4·8 to 6 mm.); ear decidedly overtopping fur.

Nasal decidedly longer than diastema [hind foot 18 to 19 mm.; condylobasal length of skull 24·8 to 25·8 mm.; colour bright, the line of demarcation along sides of body noticeable] (Skomer Island, Wales) ..... *E. skomerensis*, p. 644.

Nasal about equal to diastema, rarely much longer ..... *E. glareolus*, p. 626.

Size smaller, hind foot usually less than 18 mm. (15·4 to 18 mm.); condylobasal length of skull usually less than 24·5 mm. (21·5 to 24·5 mm.). Characteristically lowland forms.

General colour above light and bright (Drainage system of the Danube) ..... *E. g. istericus*, p. 637.

General colour above dark or dull.

Red of dorsal area showing little if any tendency to suffuse sides and rump (Central and southern Sweden; southern and eastern Norway) ..... *E. g. suecicus*, p. 636.

Red of dorsal area tending to suffuse sides and rump.

Size medium, hind foot 16·6 to 17·6 mm., condylobasal length of skull 23 to 24·6 mm.; colour dark and usually bright (West-central continental Europe) ..... *E. g. glareolus*, p. 632.

Size smallest, hind foot often less than 16·6 mm. (15·4 to 17 mm.), condylobasal length of skull often less than 23 mm. (21·5 to 24·2 mm.); colour dark and dull (Great Britain) *E. g. britannicus*, p. 634.

Size larger, hind foot usually more than 18 mm. (17 to 20 mm.); condylobasal length of skull usually more than 24·5 mm. (23 to 26·2 mm.).

Third upper molar usually with two re-entrant angles on inner side.

Red dorsal area broad, not well-defined from buffy grey sides (Western Norway) ..... *E. g. norvegicus*, p. 638.

Red dorsal area narrow, well defined from dull grey sides (Pyrenees) ..... *E. g. vasconiæ*, p. 639.

Third upper molar usually with three re-entrant angles on inner side.

Size smaller (hind foot 17 to 19 mm., condylobasal length of skull 23 to 25·4 mm.); colour lighter (Jura to south-western Alps) ..... *E. g. helveticus*, p. 640.

Size larger (hind foot 18·6 to 21 mm., condylobasal length of skull 25 to 26·2 mm.); colour darker.
Teeth weak (normal); incisive foramina narrow (normal), the width of the two together about ¼ length (Alps, except western portion)..... *E. g. nageri*, p. 641.
Teeth heavy; incisive foramina wide, the width of the two together more than ⅓ length (Southern Italy)..... *E. g. hallucalis*, p. 643.

EVOTOMYS GLAREOLUS Schreber.

(Synonymy under subspecies.)

Geographical distribution.—Europe from the Pyrenees and southern Italy to Scotland and central Scandinavia, west to Great Britain, east into Siberia. Eastern limit of range not known.

Diagnosis.—Tail about half as long as head and body or somewhat more, moderately haired, the pencil always much less than one-fourth as long as vertebræ: skull of adult delicate or moderately heavy, the condylobasal length rarely 26 mm. (21·5 to 26·2 mm.); nasal usually about as long as diastema; teeth light or moderately heavy, the length of tooth-rows rarely 6 mm. (4·8 to 6 mm.); colour variable but never so bright as in *Evotomys rutilus*, that of the larger local forms always tending to be dull.

External characters.—Form rather heavy, the head short and blunt, with rounded muzzle and small eye. Ear slightly overtopping the fur, extending barely to eye when laid forward, its outline sub-circular; meatus with well developed semilunar valve, both surfaces of which are naked; a tuft of long hairs in angle between outer extremity of valve and outer margin of ear-conch; surface of ear densely pubescent except on basal half of inner side. Muzzle pad small and inconspicuous, the aperture of the nostril slit-like, wider anteriorly than posteriorly, the margin swollen, particularly in front; upper lip with narrow median cleft continued upward across pad. Fore foot with thumb reduced to a minute tubercle scarcely half as large as the smallest pad on palm, its nail rudimentary and closely appressed, but easily visible with a lens; outer digit extending to base of fourth; second about half as long as third; fourth and third subequal; palmar tubercles five, large, sub-equal, crowded, occupying nearly the entire surface of palm, the skin between them finely tuberculo-reticulate. Hind foot with inner digit extending to base of second, outer slightly beyond base of fourth, the second, third and fourth sub-equal and about one-third as long as sole; surface of sole densely pubescent behind tubercles, naked and tuberculo-reticulate between them; tubercles six, well defined, moderately large, essentially alike in form, their outline ovate;

postero-external tubercle smaller than the others (about half as large as postero-internal). Tail about half as long as head and body or slightly more, its annulations ill defined and completely concealed by the dense covering of hair; pencil well developed, usually about one-sixth as long as vertebræ. Mammæ: $p\,2-2$, $i\,2-2=8$.

Colour.—Upper parts brown with a decided reddish or ochraceous suffusion, especially along back; sides and rump usually lighter than back, often with a tinge of grey, but never forming a decided contrast as in *Evotomys rufocanus*; underparts light grey with or without a yellowish brown wash; feet greyish; tail obscurely bicolor.

Skull.—The skull of *Evotomys glareolus* is small and lightly built, the surface smooth and rounded, without noticeable ridges or depressions for muscular attachment. Dorsal profile in general slightly convex throughout, though flattened or even a little concave in interorbital region, the nasals sloping rather abruptly forward, their surface nearly flat; there is usually no sharp distinction between dorsal and posterior outlines, the profile merely bending abruptly downward posteriorly over somewhat obliquely truncate occipital region; ventral profile shallow-concave anteriorly, then essentially straight to lower surface of bulla; depth of skull considerably greater posteriorly than anteriorly, so that the general outline formed by the two profiles is distinctly wedge-shaped. Brain-case sub-circular or very broadly oval in outline when viewed from above, sometimes a little squared at sides or in front; the surface smooth except for the small but evident postorbital processes, a distinct trace of the lambdoid crest extending downward from outer extremity of interparietal to meatus, and a shorter but more noticeable vertical ridge along upper part of suture between occipital and petrous portion of temporal, this ridge lying when skull is viewed from above in axis of concavity between paroccipital process and occipital condyle; in old individuals there is also a slightly indicated angularity extending along sides of brain-case and across median lambdoid region; interparietal convex behind, double concave in front, its lateral extremities acute or slightly truncate, its greatest antero posterior diameter about one-half to one-third transverse diameter; occiput when viewed from behind broadly arched, slightly flattened above and at sides, the median portion of brain-case not rising conspicuously above lambdoid level: paroccipital processes slender but well developed, free

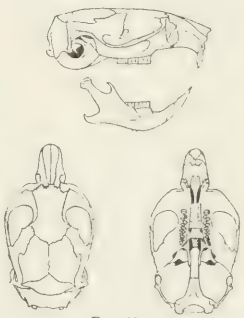

FIG. 124.
Evotomys glareolus. Nat. size.

from bullæ, their points extending to slightly below level of lower lip of foramen magnum. Floor of brain-case smooth except for a median ridge on anterior half of basioccipital; width of basioccipital along anterior border about one-third median length. Auditory bullæ large, rounded and evenly inflated, their surface smooth, their walls thin and translucent; anteriorly they overlap pterygoids for a distance of about 1 mm., though without much encroaching on pterygoid fossa or developing a noticeable beak. Interorbital region wide and smooth, its least breadth conspicuously greater than that of rostrum at region of greatest width of nasals, its upper surface with broad and shallow but noticeable longitudinal depression. Zygoma slender, scarcely expanded at middle, the arches when viewed from above strongly convex in front but spreading abruptly enough to bring the greatest zygomatic breadth a little in front of middle of orbit; anterior zygomatic root with faint concavity over infraorbital foramen. Rostrum short and weak, tapering noticeably forward when viewed either from above, below, or the side; protuberances over roots of incisors slight; nasals short, bluntly truncate posteriorly at level a little in front of middle of zygomatic root, usually somewhat exceeded by nasal branches of premaxillaries; outer border of nasal when viewed from above essentially straight from posterior border to widest region. Incisive foramina long and rather wide, extending from about 2 mm. behind alveolus of incisor to within 1 mm. of level of m^1. Palate rather short and narrow, slightly concave laterally, its posterior border, at level of anterior loop of m^3, variable in form but usually with a slight median convexity and a slight concavity at each side; mesopterygoid space long, nearly parallel-sided, the hamular processes very slightly bent outward, applied against inner surface of bullæ. Mandible slender and weak, particularly the hinder portion, into which the root of incisor penetrates so slightly as to produce no evident thickening; masseter ridge low and inconspicuous except in old individuals; coronoid process rather long, noticeably curved backward, its extremity nearly reaching level of condyle; articular process long, slender and compressed, the dental foramen lying below its base at level of cutting surface of molars; angular process slender and rather long, convex externally, concave internally, its main axis curving outward and upward.

Teeth.—Compared with those of the European species of *Microtus* the incisors are slender and weak, and the molars are small, with both salient and re-entrant angles rounded and ill-defined. Upper incisor projecting downward, the cross-section of shaft bluntly triangular, the inner surface widest, the anterior and postero-external surfaces narrower and sub-equal; enamel well defined, extending over entire anterior surface and extreme anterior portion of inner surface; cutting surface of tooth distinctly hollowed but not sufficiently to produce any suggestion

of the weakened appearance characteristic of *Lemmus* and *Myopus*, its posterior border fading gradually into surface of tooth or marked off by a slight angle. Lower incisor noticeably more slender than upper tooth, its root extending beneath that of m_3, but not rising to level of cutting surface of molars, its shaft nearly semicircular in cross section, the flattened surface directed inward, the enamel extending over anterior half of curved surface; anterior surface of both upper and lower incisors yellowish brown, posterior surface whitish. Molars relatively small and weak, at first rootless and growing from a pulp as in *Lemmus* and *Microtus*, the prisms extending uninterruptedly to base. At a slightly later stage the extreme base is seen to be smooth, forming a ring below prisms; this ring then contracts at middle and divides into two; as the cutting surface of the crown wears away and the tooth is pushed upward in the alveolus, each of these secondary rings narrows and lengthens into a prong or root standing in axis of tooth-row, the anterior

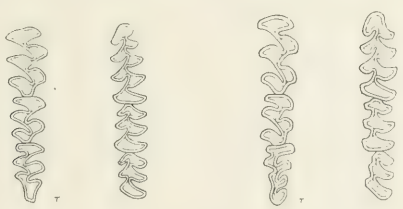

FIG. 125.

Evotomys glareolus. Enamel pattern in two individuals. × 5.

prong of each tooth somewhat larger than the posterior; with advancing age the prongs become relatively longer and the crowns lower, so that in the final stage the crowns may completely wear away, leaving in their place the flattened heads of the six roots. It follows that the enamel pattern, instead of remaining essentially constant throughout life, as in the genera with rootless molars, undergoes marked changes in the later stages of crown-wear, gradually losing its definiteness and finally disappearing. As compared with that of European voles of other genera the enamel pattern is characterized by a general lack of sharp angularity, especially in the salient angles on inner side of the maxillary teeth, where the loops assume the form of circles or semicircles rather than that of closed triangles, and by the arrangement of the prisms of the mandibular teeth in imperfectly alternating pairs, so that completely isolated and closed triangles are the exception rather than the rule. In crown length m^1 slightly exceeds m^3, which in turn is usually somewhat longer than m^2, the discrepancy in neither case very

noticeable; m_1 nearly equal to m_2 and m_3 combined, m_3 slightly shorter than m_2. First upper molar with a transverse, evenly and broadly crescentic anterior loop and four alternating, approximately equal closed triangles, those on outer side slightly the larger; each side with three salient and two re-entrant angles. In young individuals the outer re-entrant angles are conspicuously longer than those on inner side, but much more oblique in direction, so that they do not extend appreciably further beyond middle of crown; the outer salient folds are at this stage rather acute, and the inner folds though blunt are distinctly angular. With increasing age first the inner folds and later the outer folds lose their angularity and assume an indefinite rounded or semicircular form, while the discrepancy in depth between the outer and inner re-entrant angles becomes less marked. Second upper molar with anterior transverse loop, one inner and two outer closed triangles; outer side with two re-entrant and three salient angles, inner side with one re-entrant and two salient angles. Anterior loop unsymmetrical, broadly rounded internally, narrowly pointed and slightly curved backward externally; rest of crown essentially like last three prisms of m^1, but discrepancies in form between outer and inner elements less marked in youth and earlier disappearing with age. Third upper molar with anterior transverse loop similar to that of m^2 but with outer, narrowed portion relatively less developed; following this are an inner and two outer triangles, closed or variously opened, and a posterior longitudinal loop of variable form; inner triangle the largest of the three, though usually not much exceeding antero-external triangle; postero-external triangle decidedly smaller than either of the others; all three triangles may be completely isolated from each other and from terminal loops, or all may be open at both sides, leaving a continuous dentine area along middle of crown; usually the enamel of the two sides comes in contact at one or more points, and in the majority of specimens the inner triangle is completely or essentially closed. The terminal loop when at its smallest is short and perfectly simple in form, its greatest diameter oblique to the tooth-row and equal to a little more than half that of anterior loop; when at its largest its greatest diameter distinctly exceeds that of anterior loop, a shallow but evident re-entrant angle is developed at its antero-external base just behind second outer closed triangle, and its inner side is cut by a deep re-entrant angle extending across to enamel of outer side.* In its most simple form the tooth has three salient and two re-entrant angles on each side; in its most complicated form it has three salient and three re-entrant angles on outer side, four salient and four re-entrant angles on inner side. First

* This angle is best developed during the earlier and middle stages of crown-wear; later it tends to become obsolete at a less advanced stage than those forming part of the strictly normal pattern. The frequency of

lower molar with a narrowly crescentic, somewhat unsymmetrical posterior transverse loop, three inner and three outer closed or partly open triangles, and a short rounded anterior loop; outer side with three well defined salient angles and the same number of re-entrant angles, inner side with four well defined salient angles and four re-entrant angles; the number of salient angles on either or both sides may be increased by one through the assumption of a distinctly angular form by the base of the anterior loop, this occurring more frequently on the outer than on the inner side. The folds are moderately angular, those of inner side slightly the larger, but the contrast in size and form is much less evident than in the upper teeth. Second and third lower molars essentially alike in form, each consisting of three transverse loops, three inner and three outer salient angles, and two inner and two outer re-entrant angles, these last better developed in m_3 than in m_2, in which the anterior re-entrant angle is sometimes obsolete. The first and second loops of m_2 and the second loop of m_3 often show a tendency to become partly or almost completely divided into two triangles, a peculiarity more evident in the second tooth than in the third.

Remarks.—*Evotomys glareolus* is the common, widely-distributed European representative of the genus. It is divided into nine geographical races. The forms inhabiting Great Britain and the central portion of the Continent are small, while those of western Norway, the Alps, Pyrenees and the mountains of southern Italy are noticeably larger. There seems little doubt, however, that intergradation between the small and large forms takes place in every instance, though as yet it can be satisfactorily demonstrated in the case of *glareolus* and *nageri* only.

its presence or absence is also largely a racial character, as may be seen from the following tabular statement:—

	Number of specimens.	Angle present.	Angle absent.	Percentage of specimens with angle present.
E. glareolus glareolus	100	51	49	51·0
E. glareolus britannicus	43	11	32	25·5
E. glareolus suecicus	37	12	25	32·4
E. glareolus istericus	56	36	20	64·3
E. glareolus norvegicus	20	5	15	25·0
E. glareolus vasconiæ	29	8	21	27·6
E. glareolus helveticus	100	68	32	68·0
E. glareolus nageri	100	85	15	85·0
E. glareolus hallucalis	1	1	—	—
E. skomerensis	15	14	1	93·3
E. cæsarius	22	22	0	100
E. rutilus	16	16	0	100
E. rufocanus	16	1	15	6·2

Evotomys glareolus glareolus Schreber.

1780. *Mus glareolus* Schreber, Säugthiere, iv, p. 680, pl. cxc B (Lolland, Denmark).

1792. *Mus rutilus minor* Kerr, Anim. Kingd., p. 237 (Casan and Goettingen). Based on Pallas, Glires, p. 247. Not *Mus rattus minor* Kerr, Anim. Kingd., p. 229.

1792. [*Mus rutilus*] *β minor* Donndorff, Zool. Beyträge, i, p. 452. Based on Pallas, Glires, p. 247.

1803. *Lemmus arvalis* Geoffroy, Catal. Mammif. du Mus. Nat. d'Hist. Nat., p. 185 (Meudon, Seine, France). Not *Mus arvalis* Pallas.

1828. *Arvicola fulvus* Millet, Faune de Maine-et-Loire, ii, p. 40 (Angers, Maine-et-Loire, France). Not *Lemmus fulvus* Geoffroy, 1803.

1831. *Hypudæus hercynicus* Mehlis, Isis, p. 876 (Harz Mountains, Germany).

1834. *Lemmus rubidus* Baillon, Mém. Soc. Royale d'Émulation d'Abbeville, 1833, p. 54 (Abbeville, Somme, France).

1834. *H[ypudæus] glareolus* Melchior, Den Danske Stats og Norges Pattedyr, p. 116.

1836. *Arvicola rufescens* de Sélys-Longchamps, Essai Monogr. sur les Campagnols des Environs de Liége, p. 13 (Longchamps-sur-Ger, Belgium).

1842. *Arvicola pratensis* F. Cuvier, Hist. Nat. des Mammif., vii, Tabl. Gen. et Méth. Described and figured in Livr. 68 of same work, 1834 (Abbeville, Somme, France).

1857. *Arvicola glareolus* a. Blasius, Säugethiere Deutschlands, p. 337 (part).

1896. *E[votomys] glareolus* Miller, North American Fauna, No. 12, p. 44, July 23, 1896.

1900. *Evotomys hercynicus hercynicus* Miller, Proc. Washington Acad. Sci., ii, p. 100, July 26, 1900 (part).

1900. *Evotomys hercynicus rubidus* Miller, Proc. Washington Acad. Sci., ii, p. 102, July 26, 1900.

1909. *Evotomys glareolus* Miller, Ann. and Mag. Nat. Hist., 8th ser., iii, pp. 419–420, May, 1909.

1910. *Evotomys glareolus* Trouessart, Faune Mamm. d'Europe, p. 170.

Type locality.—Island of Lolland, Denmark.

Geographical distribution.—West-central Europe north of the Alps and Pyrenees and south of the Baltic; from the Atlantic coast east to Silesia; north-eastern limit of range not shown.

Diagnosis.—General colour above dark, but usually rather bright, the dorsal reddish area broad and diffuse; usual measurements of adults: hind foot, 16·6 to 18 mm., condylobasal length of skull, 23 to 24·6.

Colour.—Winter pelage: red dorsal area diffuse and ill-defined, extending from eyes nearly to base of tail and tending to spread slightly over sides. In general colour it is very nearly the mars-brown or prouts-brown of Ridgway, usually with a tinge of russet, the exact shade resulting from various combinations of cinnamon-rufous, vinaceous-rufous and black. Sides and cheeks dull brownish buff thickly sprinkled with black. The colour of sides merges insensibly into that of back and passes abruptly into the strongly buff-tinged grey of belly. The buff wash on ventral surface is variable, but usually conspicuous.

Hairs everywhere slaty at base, this colour appearing irregularly at surface on sides and underparts. Feet whitish, distinctly tinged with brown. Ear like dorsal red area. Tail sharply bicolor, dark brown above, soiled white below.

Skull and teeth.—Skull small, nearly the minimum for the species (see Table of measurements, p. 650); auditory bullæ not abruptly inflated on inner side, a character scarcely appreciable, however, except on comparison with *E. glareolus istericus*. Third upper molar with third inner re-entrant angle present in about one-half the specimens examined (see p. 631).

Measurements.—External measurements of adult male and nearly adult female from Nystad, Lolland, Denmark: head and body, 102 and 96; tail, 51 and 47; hind foot, 17·6 and 17·6. Adult male from Hilleröd, Zealand, Denmark: head and body, 98; tail, 44; hind foot, 16·5; ear from meatus, 13·5. Average and extremes of ten adults from Brunswick, Germany: head and body, 102·5 (98–111); tail, 47·3 (40–54); hind foot, 17·1 (16·6–17·6). Two adult males from Mäuseklippe, Harz Mts., Germany: head and body, 108 and 102; tail, 45 and 52; hind foot, 16·6 and 17. Adult male and female from Guines, Pas-de-Calais, France: head and body, 101 and 97; tail, 57 and 59; hind foot, 17·5 and 18·5. Two adult males from Barbizon, Seine-et-Marne, France: head and body, 103 and 108; tail, 54 and 47; hind foot, 17·6 and 17·8. For cranial measurements see Table, p. 650.

Specimens examined.—One hundred and eighty-six, from the following localities:—

Denmark: Hilleröd, Zealand, 7; Nystad, Lolland, 7 (U.S.N.M.); Odense, Fyn, 2.

Holland: Oosterbeek, Guelderland, 1; near Leiden, 2 (U.S.N.M.).

Belgium: Waremme, Liége, 28 (U.S.N.M.); Maredsous, Liége, 15; no exact locality, 1.

France: Guines, Pas-de-Calais, 2; Pont de Briques, Pas-de-Calais, 5; Dinan, Côtes-du-Nord, 4; Barbizon, Seine-et-Marne, 9; Mont-Dore, Puy-de-Dôme, 3; Lignières-Sonneville, Charente, 16 (Mottaz); Cadillac, Gironde, 1 (U.S.N.M.); Forêt de Bouconne, Gers, 1; Lyons, Rhone, 1.

Germany: Brunswick, 44 (B.M. and U.S.N.M.); Bahrenberg, Harz Mts., 2 (U.S.N.M.); Mäuseklippe, Bodethal, Harz Mts., 6 (U.S.N.M.); Ingelheim, Rheinhessen, 6; Strassburg, 4; near Magdeburg, Saxony, 5; Tharandt, Saxony, 1; Saxony, no exact locality, 1; Niesky, Silesia, 6; Gross Hennersdorf, Silesia, 2; Wolfshau, Silesia, 4 (U.S.N.M.).

Austria-Hungary: Haida, Arva, Bohemia, 1 (not typical).

2 ♂, 5 ♀.	Hilleröd, Zealand, Denmark.	O. Thomas (c & p).	98. 6. 7. 13–19.
1 st.	Odense, Fyn.	Prof. Sundeval (p).	49. 11. 1. 5.
♀.	Oosterbeek, Guelderland, Holland.	O. Thomas (c & p).	98. 2. 1. 15.
4 ♂, 4 ♀.	Maredsous, Liége, Belgium.	Rev. L. Warnau (p).	8. 10. 18. 1–8.
1.	Belgium.	E. de Sélys Longchamps (p).	45. 7. 58.
♂, ♀.	Guines, Pas-de-Calais, France.	O. Thomas (c & p).	94. 6. 6. 16–17.
♂, 4 ♀.	Boulogne, Pas-de-Calais.	O. Thomas (c & p).	98. 1. 9. 16–20.

4 ♂.	Dinan, Brittany.	G. Barrett-Hamilton (C & P).	8. 9. 29. 4–5. 11. 1. 2. 43–44.
3 ♂, 3 ♀.	Barbizon, Seine-et-Marne.	G. S. Miller (C).	8. 8. 4. 242–247.
1.	Lyons, Rhone.	Purchased.	43. 10. 14. 9.
♂.	Forêt de Bouconne, Gers. (*A. Robert.*)	O. Thomas (P).	6. 4. 1. 86.
2 ♂, 1 ♀.	Brunswick, Germany.	G. Barrett-Hamilton (C & P).	8. 9. 29. 6–7. 11. 1. 2. 45.
2 ♂, 4 ♀.	Ingelheim, Rheinhessen.	C. Hilgert (C).	8. 11. 2. 46–51.
2 ♂, 2 ♀.	Strassburg, Alsace. (*C. Mottaz.*)	O. Thomas (P).	8. 8. 10. 122–127.
3.	Magdeburg, Saxony.	Dr. W. Wolterstorff (C & P).	92. 12. 1. 18–20.
2.	Herrenkrug, Magdeburg.	Lord Lilford (P).	8. 10. 19. 4–5.
♀ al.	Tharandt, Saxony. (*Nitsche.*)	Berlin Museum (E).	93. 1. 1. 21.
1.	Saxony.	Dr. Thienemann (P).	45. 11. 15. 18.
2 ♂, ♀.	Niesky, Silesia, Germany. (*W. Baer.*)	Dr. E. Hamilton (P).	97. 12. 4. 24–26.
2 ♂, ♀.	Niesky, Silesia. (*W. Baer.*)	Lord Lilford (P).	99. 1. 9. 23, 24, 26.
♂, ♀.	Gross Hennersdorf, Silesia. (*W. Baer.*)	Lord Lilford (P).	99. 1. 9. 22, 25.
♂.	Haida, Bohemia.	Lord Lilford (P).	8. 10. 19. 1.

Evotomys glareolus britannicus Miller.

1832. *Arvicola riparius* Yarrell, Proc. Zool. Soc., London, p. 109 (England, no exact locality). Not of Ord, 1825.

1900. *Evotomys hercynicus britannicus* Miller, Proc. Washington Acad. Sci., II, p. 103, July 26, 1900 (Basingstoke, Hampshire, England). Type in British Museum.

1910. *Evotomys glareolus britannicus* Trouessart, Faune Mamm. d'Europe, p. 170.

Type locality.—Basingstoke, Hampshire, England.

Geographical distribution. Great Britain.

Diagnosis.—Like *Evotomys glareolus glareolus*, but colour usually less intense, and average size smaller (hind foot, 15·4 to 17 mm.; condylobasal length of skull, 21·4 to 24·2 mm.).

Measurements.—Type (adult male, from Basingstoke, Hampshire, England): head and body, 105; tail, 51; hind foot, 16·6. Average and extremes of eight adults from the type locality: head and body, 103·4 (98–107); tail, 49·3 (44–54); hind foot, 16·3 (15·4–17). Two adult females from Aberia, Merionethshire: head and body, 100 and 101; tail, 48 and 45; hind foot, 16·4 and 15·8. Two adult females from Dunphail, Elgin, Scotland: head and body, 102 and 110; tail vertebræ, 55 and 51; hind foot, 16 and 16·8. For cranial measurements see Table, p. 652.

Specimens examined.—One hundred and eighty-three, from the following localities:—

Scotland: Birnie, Morayshire, 2; Dunphail, Elgin, 5; Fochabers, Elgin (Edinburgh), 1; Lhanbride, Elgin, 1; Cortachy, Forfar, 1 (Wilson); Dunkeld, Perthshire, 1; Loch Earn Head, Perthshire, 1; Windygates, Fife, 12 (Edinburgh); Dalmeney Park, Edinburgh, 2; Grantown-on-Spey,

Edinburgh, 1 (Wilson); Cromlix, Dunblane, 5; Blackwood, Lanarkshire, 5; Stockbriggs, Lanarkshire, 2; Drumlaurig Woods, Dumfriesshire, 2; Kirtle Bridge, Dumfriesshire, 1; Dumfriesshire, no exact locality, 1; Craigmere, Galloway, 3 (Edinburgh).

ENGLAND: Filey, Yorkshire, 1; Lanfair, Anglesey, 3; Llansligo, Anglesey, 2; Plas Maclog, Anglesey, 1; Parkgate West, Cheshire, 1; Higher Sutton, Macclesfield, Cheshire, 1; Northenden, Cheshire, 5; Aberia, Merionethshire, 7; Langharne, Carmarthenshire, 4; Bridgend, Glamorganshire, 1; Swansea, Glamorganshire, 1; Colwyn Bay, Denbighshire, 1; Grimsby, Lincolnshire, 18; Waltham, Lincolnshire, 1; Herefordshire, 2; Arley, Staffordshire, 2; Cheadle, Staffordshire, 1; Swithland, Leicestershire, 3; Lilford, Northamptonshire, 3; Oundle, Northamptonshire, 1; Histon, Cambridgeshire, 1; Worcestershire, 1; Wormsley, Oxfordshire, 4; Luton, Bedfordshire, 2; Toddington, Bedfordshire, 1; Welwyn, Hertfordshire, 1; Lowestoft, Suffolk, 2; Chelmsford, Essex, 1; Hillingdon, Middlesex, 6; Betchworth, Surrey, 2; Bletchingley, Surrey, 7; Godalming, Surrey, 2; Kingston, Surrey, 1; Sussex, 1; Basingstoke, Hampshire, 13; New Forest, Hampshire, 2; Eversley, Hampshire, 8; Bembridge, Isle of Wight, 4; St. Helens, Isle of Wight, 1; Salisbury, Wiltshire, 1; Pill-on-Avon, Somerset, 1; Blandford, Dorset, 1; Bridport, Dorset, 9; Northlew, Devonshire, 6.

♂.	Birnie, Morayshire, Scotland.	E. R. Alston (P).	79. 9. 25. 58.
♀ al.	Birnie, Morayshire.	Rev. G. Gordon (C & P).	88. 11. 22. 1.
4 ♂, 1 ♀.	Dunphail, Elgin.	W. R. Ogilvie-Grant (C & P).	11. 1. 3. 209–210. 11. 1. 3. 239–241.
♀.	Llanbride, Elgin.	W. Taylor (C & P).	11. 1. 3. 238.
2 ♀.	Dunblane, Perthshire.	W. R. Ogilvie-Grant (C & P).	11. 1. 3. 211–212.
2 ♂.	Dalmeny. Edinburgh.	W. Evans (C & P).	11. 1. 3. 235–236.
♂, 2 ♀.	Cromlix, Stirlingshire.	W. R. Ogilvie-Grant (C & P).	11. 1. 3. 243–245.
2 ♂.	Stockbriggs, Lanarkshire.	E. R. Alston (C & P).	79. 9. 25, 56–57.
2.	Drumlaurig Woods, Dumfriesshire.	Jardine Collection.	86. 7. 2. 9–10.
♂.	Kirtle Bridge, Dumfriesshire.	Miss D. Bate (C & P).	11. 1. 3. 242.
♂, 1.	Lanfair, Anglesey, Wales.	C. Oldham (C & P).	11. 1. 3. 229–230.
♂.	Plas Maclog, Anglesey.	T. A. Coward (C & P).	11. 1. 3. 234.
1.	Northenden, Cheshire, England.	G. Barrett-Hamilton (P).	11. 1. 3. 237.
♂, ♀ al.	Aberia, Merionethshire, Wales.	G. H. Caton Haigh (C & P).	94. 6. 5. 1–2.
2 ♂, 3 ♀.	Aberia, Merionethshire.	G. Caton Haigh (C & P).	11. 1. 3. 231. 253–256.
4 ♀.	Langharne, Carmarthenshire.	W. E. de Winton (C & P).	11. 1. 3. 257–260.
♀.	Bridgend, Glamorganshire.	R. I. Pocock (C & P).	11. 1. 3. 232.
♂.	Swansea, Glamorganshire.	C. Oldham (C & P).	11. 1. 3. 233.
♀.	Waltham, Lincolnshire, England.	G. H. Caton Haigh (C & P).	11. 1. 3. 213.
1 al.	Herefordshire.	Rev. S. O. Ridley (C & P).	82. 1. 28. 1.
1 al.	Bishopstone, Herefordshire.	Rev. S. O. Ridley (C & P).	81. 1. 1. 3.
♂.	Worcestershire.	J. S. Elliott (C & P).	11. 1. 3. 214.

♂, ♀.	Wormsley, Oxfordshire.	W. R. Ogilvie-Grant (c & p).	11. 1. 3. 215–216.
♀. (albino)	Toddington, Bedfordshire.	Joseph Scrivner (c & p).	98. 2. 27. 1.
♂.	Welwyn, Hertfordshire.	W. R. Ogilvie-Grant (c & p).	11. 1. 3. 217.
2 juv. al.	Hillingdon, Middlesex.	O. Thomas (c & p).	80. 10. 14. 1–2.
♂, 3 ♀.	Hillingdon, Middlesex.	O. Thomas (c & p).	11. 1. 3. 219. 250–252.
♂.	Surrey.	W. R. Ogilvie-Grant (c & p).	11. 1. 3. 218.
♀.	Kingston, Surrey.	C. H. B. Grant (p).	11. 1. 3. 404.
♀.	Sussex.	W. R. Ogilvie-Grant (c & p).	11. 1. 3. 220.
2 ♀.	Basingstoke, Hampshire.	G. S. Miller (c). (7. 7. 7. 2944.	7. 7. 7. 2943–4. *Type* of subspecies.)
2 ♂, 9 ♀.	Basingstoke, Hampshire.	G. S. Miller (c).	7. 7. 7. 2947–55, 2976–7.
♂, ♀.	New Forest, Hampshire.	G. S. Miller (c).	7. 7. 7. 2969, 2937.
4 ♂, 4 ♀.	Eversley, Hampshire.	G. S. Miller (c).	7. 7. 7. 2939–40, 2956–7, 2972–3, 2978–9.
2 ♂, 2 ♀.	Bembridge, I. of Wight.	W. R. Ogilvie-Grant (c & p).	11. 1. 3. 221–224.
♀.	St. Helens, I. of Wight.	O. Thomas (c & p).	11. 1. 3. 225.
juv.	Salisbury, Wiltshire.	E. R. Alston (p).	79. 9. 25. 59.
♀.	Pill-on-Avon, Somerset.	R. I. Pocock (p).	11. 1. 3. 226.
3 ♂, 3 ♀.	Northlew, Devonshire.	R. C. Wroughton (p).	11. 1. 3. 227 228, 261–264.

Evotomys glareolus suecicus Miller.

1900. *Evotomys hercynicus suecicus* Miller, Proc. Washington Acad. Sci., II, p. 101, July 26, 1900 (Upsala, Sweden). Type in U.S. National Museum.

1910. *Evotomys glareolus suecicus* Trouessart, Faune Mamm. d'Europe, p. 171.

Type locality.—Upsala, Sweden.

Geographical distribution.—Lowlands of Sweden, Finland and south-eastern watershed of Norway.

Diagnosis.—Similar to *Evotomys glareolus glareolus*, but red dorsal area narrower and less diffuse, and sides, face, and rump more grey.

Colour.—The elements of the colour are essentially as in *E. glareolus glareolus*, but the reddish brown is more strictly confined to the back, and the grey element on sides is more conspicuous.

Skull and teeth.—The skull and teeth resemble those of the typical race, except that third re-entrant angle on inner side of m^3 appears to be considerably less often present (see Table, p. 631).

Measurements.—Type (young adult female from Upsala, Sweden): head and body, 96; tail, 42; hind foot, 18. Average and extremes of six specimens from the type locality: head and body, 94·3 (92–103); tail, 41 (38–43); hind foot, 16·9

(16·4–17·6). Average and extremes of eight specimens from Eggedal, Buskerud, Norway: head and body, 97·5 (92–102·5); tail, 54·6 (52–59); hind foot, 16·6 (16·4–17). For cranial measurements see Table, p. 650.

Specimens examined.—One hundred and four, from the following localities:—

NORWAY: Asker, Christiania, 7 (B.M. and U.S.N.M.); Lillehammer, Hedemarken, 18 (U.S.N.M.); Eggedal, Buskerud, 27 (U.S.N.M.); Spjosod, Telemarken, 33 (U.S.N.M.); Mölmen, Kristiansamt, 2; Holaaker, Kristiansamt, 2.

SWEDEN: Kvickjock, Norbotten, 2 (B.M. and U.S.N.M.), identification not positive; Upsala, 7 (U.S.N.M.); Medelpad, west Norrland, 2; Småland, 2.

♂, ♀.	Medelpad, W. Norrland, Sweden.	Lord Lilford (P).	8. 10. 19. 2–3.
2.	Småland.	Prof. Sundevall (C).	49. 11. 1. 3, 5.
1.	Kvickjock, Norbotten.	Prof. Sundevall (C).	45. 10. 25. 7.
2 ♂.	Holaaker, 1900 ft.	R. J. Cuninghame (C & P).	98. 2. 28. 8–9.
2 ♂.	Mölmen.	R. J. Cuninghame (C & P).	98. 5. 2. 3–4.
♂, ♀.	Asker, Christiania.	Christiania Museum (E).	93. 3. 1. 14–15.

EVOTOMYS GLAREOLUS ISTERICUS Miller.

1900. *Evotomys hercynicus hercynicus* Miller, Proc. Washington Acad. Sci., II, p. 100, July 26, 1900 (part; specimens from Marxheim, Bavaria, and Bustenari, Roumania).

1909. *Evotomys glareolus istericus* Miller, Ann. and Mag. Nat. Hist., 8th ser., III, p. 419, May, 1909. Type in British Museum.

1910. *Evotomys glareolus istericus* Trouessart, Faune Mamm. d'Europe p. 172.

Type locality.—Bustenari, Prahova, Roumania (in the Carpathians, north-west of Bucharest; altitude 480 m.).

Geographical distribution.—Drainage basin of the Danube, from Bavaria through Hungary to Roumania and probably to Bulgaria and the coast of the Black Sea.

Diagnosis.—Auditory bullæ more abruptly inflated on inner side than in the typical subspecies; colour lighter and more yellow than in the other races, the red of rather narrow dorsal area a clear yellowish rufous.

Colour.—Summer pelage: dorsal stripe narrow and well defined, not tending to spread over sides. It is rufous slightly varied with yellowish wood-brown, and rather thickly sprinkled with black-tipped hairs. Face, cheeks, and sides pale yellowish wood-brown, tinged with grey; underparts varying from creamy white to a yellowish cream-buff. Rump like sides, rather strongly contrasted with dorsal stripe. Feet greyish white. A dark shade at ankle. Ears thinly haired, like dorsal stripe in colour. Tail sharply bicolor, brown above becoming darker at tip, soiled white below. Winter pelage: dorsal stripe slightly less sharply defined than in summer, the rufous paler but warmer,

considerably varied with wood-brown, but very inconspicuously sprinkled with black-tipped hairs. Face, cheeks and sides more yellowish wood-brown than in summer, and scarcely tinged with grey. Rump slightly suffused with colour of dorsal area, and therefore less contrasted with back than in summer. Feet nearly pure white.

Skull and teeth.—The skull resembles that of the typical race except that the auditory bullæ are larger, their inner margins more nearly approaching each other, and rising more abruptly above level of basioccipital. Teeth as in *E. glareolus glareolus;* third upper molar with third re-entrant angle on inner side present in about 64 per cent of fifty-six skulls examined.

Measurements.—Type (adult male), from Bustenari, Roumania: head and body, 96; tail, 43·5; hind foot, 17·4; ear from meatus, 10·5. Average and extremes of five adults from Hatszeg, Hunyad, Hungary: head and body, 105·4 (99–111); tail, 45·4 (40–49); hind foot, 17·8 (17·4–18). Average and extremes of ten adults from Marxheim, Bavaria, Germany: head and body, 96·0 (93–103); tail, 46·0 (43–49); hind foot, 17·7 (17–18). For cranial measurements see Table, p. 651.

Specimens examined.—Sixty-six, from the following localities:—

GERMANY: Strass, near Burgheim, Bavaria, 5; Marxheim, Bavaria, 48 (B.M. and U.S.N.M.).

AUSTRIA-HUNGARY: Csallóköz-Somorja, Pressburg, Hungary, 1; Hatszeg, Hunyad, Hungary, 11.

ROUMANIA: Bustenari, Prahova, 1.

3 ♂.	Strass, Burgheim, Bavaria. (*Körbitz.*)	Lord Lilford (P).	8. 10. 19. 6–8.
5 ♂, 5 ♀.	Marxheim, Bavaria.	Lord Lilford (P).	8. 10. 19. 9–18.
1.	Csallóköz-Somorja, Pressburg, Hungary.	Budapest Mus. (E).	94. 3. 1. 59.
8 ♂, 2 ♀.	Hatszeg, Hunyad, Transylvania.	C. G. Danford (C).	3. 2. 2. 35–44.
♂.	Hatszeg, Hunyad, Transylvania.	C. G. Danford (C).	3. 11. 8. 34.
♂.	Bustenari, Prahova, Roumania. (*W. Dodson.*)	Lord Lilford (P).	4. 4. 6. 72. (*Type* of subspecies.)

EVOTOMYS GLAREOLUS NORVEGICUS Miller.

1900. *Evotomys norvegicus* Miller, Proc. Washington Acad. Sci., II, p. 93, July 26, 1900. Type in U.S. National Museum.

1910. *Evotomys norvegicus* Trouessart, Faune Mamm. d'Europe, p. 166.

Type locality.—Bergen, Norway.

Geographical distribution.—Western Norway, north at least to Nordland; apparently confined to the western watershed.

Diagnosis.—Larger than *Evotomys glareolus glareolus* (hind foot in adults, 18·4 to 19 mm., condylobasal length of skull, 24·2 to 26·2 mm.); skull noticeably more robust than in the small races, the zygomata very abruptly spreading anteriorly; third upper molar usually with two re-entrant angles on inner

side; red dorsal area broad, not well defined from buffy grey sides of body.

Colour.—Summer pelage: dorsal stripe dull ferruginous slightly varied with light wood-brown and much darkened by a uniform sprinkling of black-tipped hairs, fading rather abruptly into the light wood-brown of face, cheeks and sides; rump wood-brown tinged with red in median line and forming no noticeable contrast with colour of back; underparts pale drab-grey, washed to a varying degree with yellowish brown and irregularly darkened by appearance at surface of slaty under colour; feet dull white, a dark shade at inner side of ankle; tail sharply bicolor, dark brown above, whitish below.

Skull.—The skull is decidedly larger and more heavily built than that of *Evotomys glareolus glareolus* and the other small races. Zygomata heavy, abruptly spreading anteriorly, the greatest zygomatic width at level of front of molar series. Postorbital processes distinct but very small. Brain-case moderately high and rounded, distinctly rectangular in outline when viewed from above. Nasals squarely truncate posteriorly a little in front of tips of nasal branches of premaxillaries.

Teeth.—The teeth are larger than those of true *Evotomys glareolus*, and the third upper molar usually has only two re-entrant angles on inner side. Otherwise they show no peculiarities.

Measurements.—Type (adult male from Bergen, Norway): head and body, 108; tail, 57; hind foot, 18·6. Average and extremes of eight adults from Graven, Hardanger, Norway: head and body, 109·8 (104·5–115); tail, 57·5 (55–60·5); hind foot, 18·7 (18·4–19). For cranial measurement see Appendix.

Specimens examined.—Twenty-six, from the following localities in western Norway: Mo, Ranen, Nordland, 2 (U.S.N.M.); Saltdalen, Bodö, Nordland, 3; Söndfjord, 1; Bergen, 4 (U.S.N.M.); Opheim, Bergen, 2; Graven, Hardanger, 14.

3.	Saltdalen, Bodö, Norway.	Dr. R. Collett (P).	84. 10. 31. 8–10.
Skull.	Söndfjord.	Dr. R. Collett (P).	84. 10. 13. 12.
♂, ♀.	Graven, Hardanger. (*Miss Stejneger.*)	U.S. Nat. Mus. (E).	5. 8. 5. 1–2.

EVOTOMYS GLAREOLUS VASCONIÆ Miller.

1900. *Evotomys vasconiæ* Miller, Proc. Washington Acad. Sci., II, p. 96, July 26, 1900. Type in U.S. National Museum.

1910. *Evotomys vasconiæ* Trouessart, Faune Mamm. d'Europe, p. 168.

Type locality.—Montréjeau, Haute-Garonne, France.

Geographical distribution.—Pyrenees and region at their immediate base (at present known from the French side only).

Diagnosis.—Size as in *Evotomys glareolus norvegicus* or slightly greater (hind foot in adults, 18·6 to 19·6 mm., condylobasal

length of skull, 25 to 26 mm.) ; third upper molar usually with two re-entrant angles on inner side (see Table, p. 631) ; red of dorsal area narrower and not so bright, and sides less buffy.

Measurements.—Type (adult male): head and body, 107 ; tail, 53 ; hind foot, 19. Adult female from Caterille, Haute-Garonne, France : head and body, 97 ; tail, 44 ; hind foot, 18·8. Adult male and female from l'Hospitalet, Ariège, France : head and body, 112 and 110 ; tail, 54 and 60 ; hind foot, 19·6 and 18·8. Two adult females from Porté, Pyrénées-Orientales, France : head and body, 110 and 112 ; tail, 55 and 56 ; hind foot, 19 and 19. For cranial measurements see Table, p. 654.

Specimens examined.—Thirty-four, from the following localities in France: Porté, Pyrénées-Orientales, 11; l'Hospitalet, Ariège, 5; Ax-les-Thermes, Ariège, 4; Caterille, Haute-Garonne, 6; Luchon, Haute-Garonne, 1; Montréjeau, Haute-Garonne, 2 (U.S.N.M.); Barèges, Hautes-Pyrénées, 5.

♂, 2 ♀.	Porté, Pyrénées-Orientales, France.	G. S. Miller (c).	8. 8. 4. 248-250.
2 ♂, ♀.	Porté, Pyrénées-Orientales. (*A. Robert.*)	O. Thomas (p).	8. 9. 1. 59–61.
♂, ♀.	L'Hospitalet, Ariège. (*A. Robert.*)	O. Thomas (p).	8. 9. 1. 62–63.
2 ♂.	Ax-les-Thermes, Ariège.	V. Builles (p).	8. 3. 27. 12–13.
♂, ♀.	Ax-les-Thermes, Ariège.	G. S. Miller (c).	8. 8. 4. 252–253.
5 ♂, ♀.	Caterille, Haute-Garonne. (*A. Robert.*)	O. Thomas (p).	6. 4. 1. 87–92.
♀.	Luchon, Haute-Garonne. (*A. Robert.*)	O. Thomas (p).	6. 4. 1. 93.
♀.	Barèges, Hautes-Pyrénées.	G. S. Miller (c).	8. 8. 4. 251.

Evotomys glareolus helveticus Miller.

1900. *Evotomys hercynicus helveticus* Miller, Proc. Washington Acad. Sci., II, p. 98, July 26, 1900. Type in British Museum.

1910. *Evotomys glareolus helveticus* Trouessart, Faune Mamm. d'Europe, p. 171.

Type locality.—Montauban, Haute-Savoie, France (near Geneva, Switzerland). Altitude, 900 m.

Geographical distribution.—Jura Mountains ; south through the non-Alpine parts of Switzerland and along the lower western portion of the French Alps.

Diagnosis.—Intermediate between *Evotomys glareolus glareolus* and *E. g. nageri* in size (hind foot, 17 to 19 mm., condylobasal length of skull, 23 to 25·4 mm.), but colour somewhat paler and more buffy greyish than in either.

Measurements.—Type (young adult male): head and body, 95 ; tail, 45 ; hind foot, 18 ; ear, 15. Adult male and female from the type locality : head and body, 100 and 101 ; tail, 43 and 51 ; hind foot, 19 and 19. Average and extremes of ten adults from Cranves-Sales, Haute-Savoie : head and body, 101 (98–105) ; tail, 49·2 (48–52) ; hind foot, 18·3 (17·6–19). Average and

extremes of ten adults from Barcelonnette, Basses-Alpes, France: head and body, 110·4 (103–117); tail, 55·3 (49–58); hind foot, 18·5 (17·6–18·6). Five adults from Geneva, Switzerland: head and body, 114·4 (103–122); tail, 47·8 (45–53); hind foot, 17·9 (17–18). Seven adults from St. Cergues, Vaud, Switzerland: head and body, 107 (101–111); tail, 46 (42–50); hind foot, 17·8 (17·4–18·2). For cranial measurements see Table, p. 654.

Specimens examined.—One hundred and twenty-nine, from the following localities:—

SWITZERLAND: St. Cergues, Vaud, 27 (U.S.N.M. and Mottaz); Geneva, 23 (U.S.N.M. and Mottaz).

FRANCE: Montauban, Haute-Savoie, 21; Lucinges, Haute-Savoie, 12; Cranves-Sales, Haute-Savoie, 12; Scientriers, Haute-Savoie, 8 (Mottaz); Barcelonnette, Basses-Alpes, 15 (B.M. and U.S.N.M.); Saint Paul, near Barcelonnette, Basses-Alpes, 11.

♂.	Montauban, Haute-Savoie, 900 m. France. (*A. Robert.*)	O. Thomas (P).	2. 6. 7. 1. (*Type* of subspecies.)
6 ♂, 5 ♀.	Cranves-Sales, Haute-Savoie. (*A. Robert.*)	O. Thomas (P).	5. 11. 18. 33–43.
♂, ♀.	Barcelonnette, Basses-Alpes.	U.S. Nat. Mus. (E).	5. 8. 5. 3–4.
4 ♂, 2 ♀.	St. Paul, Basses-Alpes. (*C. Mottaz.*)	O. Thomas (P).	8. 8. 10. 116–121.

EVOTOMYS GLAREOLUS NAGERI Schinz.

1845. *Hyp*[*udæus*] *nageri* Schinz, Synops. Mamm., II, p. 237 (Oberalpsee, Urserenthal, Uri, Switzerland).

1857. *Arvicola glareolus* b. Blasius, Säugethiere Deutschlands, p. 337.

1862. *Myodes bicolor* Fatio, Rev. et Mag. de Zool., 2nd ser., XIV, p. 257, July, 1862 (Genthal, Berne, Switzerland). Type in Geneva Museum.

1900. *Evotomys nageri* Miller, Proc. Washington Acad. Sci., II, p. 94, July 26, 1900.

1910. *Evotomys nageri* Trouessart, Faune Mamm. d'Europe, p. 167.

Type locality.—Oberalpsee, near Andermatt, Uri, Switzerland.

Geographical distribution.—Alps (except westernmost portion) and mountains of northern Italy.

Diagnosis.—Size slightly larger than in *Evotomys norvegicus* (usual measurements of adults: hind foot, 18·8 to 20 mm.; condylobasal length of skull, 25 to 26·2 mm.); third upper molar usually with three re-entrant angles on inner side; dorsal red area narrow and dark, the sides of body dull greyish in evident though not conspicuous contrast.

Colour.—Dorsal stripe rather well defined, extending from forehead to rump, but not showing much tendency to spread laterally. It is cinnamon-rufous slightly varied with pale broccoli-brown and inconspicuously darkened by a sprinkling of black-tipped hairs; the resulting colour approaching chestnut, or something lighter and more yellowish. Face, cheeks and sides

light hair-brown fading to smoky grey on lower part of sides. Rump light broccoli-brown tinged with reddish-brown in median line, and forming in most specimens a distinct though not very noticeable contrast with dorsal stripe. Whole ventral surface pale smoke-grey, washed to a varying degree with yellowish brown, especially along median line, the slate-grey bases of the hairs appearing irregularly at surface. Feet dull white ; a dark shade at inner side of ankle. Ears thinly haired, dull reddish brown. Tail bicolor, dark brown above, buffy whitish below. The winter pelage tends to be darker than the summer pelage, with less contrast between colours of dorsal stripe and sides ; but dull, brownish individuals are not infrequently met with in summer.

Skull and teeth.—Skull largest among the Continental European members of the group, *E. glareolus hallucalis* perhaps excepted. In form it shows no special peculiarities. Brain-case relatively large, a peculiarity more noticeable in smooth, young-adult skulls than in those which have become angular with advancing age. Zygomata not very abruptly spreading in front, the middle portion of the two arches usually almost parallel. Incisive foramina narrow (normal), the width of the two together about one-quarter length. Molars distinctly larger than in *E. glareolus glareolus*, but pattern of enamel folding with no other peculiarity than that the third re-entrant angle on inner side of m^3 is usually present (see Table, p. 631).

Measurements.—Adult male from Les Plans, Vaud, Switzerland : head and body, 105 ; tail, 65 ; hind foot, 19·8. Average and extremes of four adults from Brünig, Switzerland : head and body, 105·7 ; tail, 61·7 ; hind foot, 19·3 (18·8–20). Average and extremes of ten adults from Andermatt, Uri, Switzerland : head and body, 106·3 (101–112) ; tail, 64·5 (59–72) ; hind foot, 18·8 (18·6–19). Average and extremes of four adults from Göschenen, Uri, Switzerland : head and body, 117·7 (114–123) ; tail, 64·2 (62–68) ; hind foot, 19·6 (19–20) Two adult males from Gordola, Locarno, Ticino, Switzerland : head and body, 103 and 103 ; tail, 62 and 65 ; hind foot, 19·6 and 19·3 ; ear from meatus, 13·5 and 13. Adult male and female from Lugano, Ticino, Switzerland : head and body, 106 and 107 ; tail, 48 and 49 ; hind foot, 19·8 and 20. For cranial measurements see Table, p. 653.

Specimens examined.—One hundred and seventy-five, from the following localities :—

France : Chamonix, Haute-Savoie, 8 (U.S.N.M.).

Switzerland : Les Plans, Vaud, 7 (U.S.N.M.) ; Zermatt, Valais, 10 (U.S.N.M.) ; Brünig, Berne, 20 (U.S.N.M.) ; Meiringen, Berne, 11 (U.S.N.M.) ; Genthal, Berne, 1 (Geneva ; type of *bicolor* Fatio) ; Lucerne, 2 ; Vitznau, Lucerne, 10 (B.M. and U.S.N.M.) ; Göschenen, Uri, 8 (U.S.N.M.) ; Andermatt, Uri, 49 (U.S.N.M.) ; Vulpera-Tarasp, Grisons, 14 (Rothschild) ; Campfer, Grisons, 5 (Rothschild) ; Untervatz, Grisons, 3 ; Poschiavo, Grisons, 1 (Mottaz) ; Faido, Ticino, 1 (U.S.N.M.) ; Lugano, Ticino, 5 (U.S.N.M. and Mottaz) ; Gordola, Locarno, Ticino, 3.

ITALY: Padola, Cadore, 1 (Turin); Casamazzagno, Cadore, 1 (Turin); Ceresole d'Alba, Turin, 2; Stupinigi, Turin, 1 (Turin); Moncalieri, Turin, 9 (U.S.N.M. and Turin); Ambonasco, in mountains above Chiavari, Liguria, 2 (Genoa); no exact locality, 1.

♂, 4 ♀.	Vitznau, Lucerne, Switzerland.	O. Thomas (C & P).	5. 8. 3. 22–26.
3 ♂.	Untervatz, Grisons.	Lord Lilford (P).	1. 11. 7. 15–17.
2 ♂, ♀.	Locarno, Ticino.	O. Thomas (C & P).	5. 8. 2. 15–17.
♂, ♀.	Turin, Italy.	Dr. E. Festa (C & P).	8. 8. 1. 3–4.
1.	Italy.	Purchased (Brandt).	53. 11. 19. 2, 4.

EVOTOMYS GLAREOLUS HALLUCALIS Thomas.

1882. *Arvicola glareolus* Cavanna, Bull. Soc. Entomol. Ital., XIV, p. 87 (Serra Crispo, Monte Pollino, Basilicata, Italy).

1906. *Evotomys nageri hallucalis* Thomas, Ann. and Mag. Nat. Hist 7th ser., XVIII, p. 221, September, 1906. Type in British Museum

1910. *Evotomys nageri hallucalis* Trouessart, Faune Mamm. d'Europe, p. 168.

Type locality.—Santa Eufemia d'Aspromonte, Calabria, Italy.

Geographical distribution.—High mountains of southern Italy.

Diagnosis.—Externally similar to *Evotomys glareolus nageri*, but underparts less washed with yellowish brown; skull with longer, narrower brain-case and rather shorter rostrum than in *nageri*, the incisive foramina shorter and wider than in the related forms; teeth larger than in any other European species except *E. cæsarius* and *E. rufocanus*.

Colour.—Except that the underparts are a light grey washed with whitish cream-buff the colour is similar to that of *Evotomys glareolus nageri*. Line of demarcation along sides ill defined. Feet dull whitish, somewhat lighter than usual in *E. g. nageri*.

Skull.—Although the only known skull is somewhat imperfect its form appears to be notably different from that of *Evotomys glareolus nageri* and the other members of the group in the decided elongation of the brain-case and a slight shortening of the rostrum. Length of brain-case measured from back of interparietal to line joining tips of postorbital processes nearly equal to zygomatic breadth, instead of decidedly less than zygomatic breadth as in the related large forms. Interorbital region rather wide and smooth, a character probably due in part at least to the comparative youth of the specimen (roots of molars less tham 1 mm. long). Rostrum relatively shorter than in *E. g. nageri*, and incisive foramina much shorter and wider, the greatest breadth of the two together decidedly more than one-third length of foramen instead of about one-fourth as in the related species.

Teeth.—The incisors are slightly more slender than usual in *Evotomys glareolus nageri*, though a few specimens from the Alps are essentially the same. Molars heavier than in *E. g. nageri*, though not peculiar in form, the length of the upper series more

nearly approaching length of diastema than in any other European species except the similarly heavy-toothed *E. cæsarius*. Third upper molar with well developed third inner re-entrant angle.

Measurements.—Type (young adult male): head and body, 115; tail, 66; hind foot, 21; ear from meatus, 13. For cranial measurements see Table, p. 653.

Specimen examined.—The type.

Remarks.—Although at present very imperfectly known the south Italian *Evotomys* appears to be a well-characterized race.

Aspromonte, Calabria. (*A. Robert.*) O. Thomas (P). 6. 8. 4. 9. (*Type* of subspecies.)

EVOTOMYS SKOMERENSIS Barrett-Hamilton.

1903. *Evotomys skomerensis* Barrett-Hamilton, Proc. Royal Irish Acad., xxiv, p. 316. Type in British Museum.

1910. *Evotomys skomerensis* Trouessart, Faune Mamm. d'Europe, p. 167.

Type locality.—Skomer Island, off coast of Pembrokeshire, Wales.

Geographical distribution.—Skomer Island.

Diagnosis.—Size as in the other large European members of the genus; tail about half as long as head and body; colour above unusually light and bright, sharply and conspicuously contrasted with buffy white of underparts; skull about as large as that of *E. nageri*, but with brain-case unusually ridged and angular, and nasals decidedly longer than diastema, rather abruptly narrowed near middle.

Colour.—Winter pelage: upper parts a bright light reddish brown approaching the orange-rufous of Ridgway, a narrow area on sides paler and with a distinct buffy suffusion; underparts and entire fore leg strongly contrasted whitish grey, faintly tinged with pale buff (the combination much paler than the cream-buff of Ridgway), the line of demarcation along sides well defined; tail sharply bicolor, brownish above, pale cream-buff below; feet buffy white above, pale hair-brown on furred portion of sole. Summer pelage not known.

Skull.—The skull differs notably from that of *Evotomys glareolus nageri* and *E. g. norvegicus* in the short, broad, rather strongly ridged and angled brain-case, the conspicuous development of the mastoid region, which stands out more strongly from general outline of brain-case than in any of the related species, and the unusual length of the nasals, which distinctly exceed the diastema. Instead of diminishing gradually in width from before backward, as in the related species, the nasals contract rather abruptly near middle, so that their general outline is almost spatulate. The nasals are more abruptly bent downward anteriorly than in *E. glareolus nageri* and *E. g. norvegicus*. Otherwise the dorsal profile is nearly flat, like that of the Alpine

animal. The depth of the entire skull from occipital region to anterior base of zygomata is relatively greater than in any of the other European species except *E. cæsarius*. Postorbital processes small but unusually prominent and well defined, a well developed ridge extending obliquely backward and upward from each process nearly to anterior edge of parietal. Rostrum and incisive foramina normal. Zygomata rather abruptly flaring, about as in *E. glareolus norvegicus*. Auditory bullæ relatively larger than in the large forms of *Evotomys glareolus*.

Teeth.—The teeth are essentially like those of *Evotomys glareolus nageri;* third upper molar normally with three re-entrant angles on inner side (see Table, p. 631).

Measurements.—Type (adult male): head and body, 108; tail, 59; hind foot, 18; ear from meatus, 13. Average and extremes of ten adults: head and body, 109·7 (105–121); tail, 55·5 (50–61); hind foot, 18·4 (18–19); ear from meatus, 13·5 (13–14). For cranial measurements see Table, p. 656.

Specimens examined.—Thirteen, all from Skomer Island (B.M. and U.S.N.M.).

5 ♂, 2 ♀.	Skomer Island, S.W. Wales.	Y. H. Mills (C & P).	3. 7. 4. 1–7. (3. 7. 4. 3. *Type* of species.)
1 al.	Skomer Island.	R. Drane (C & P).	4. 8. 5. 1.
2.	Skomer Island.	R. Drane (C & P).	11. 1. 3. 265–266.

EVOTOMYS CÆSARIUS Miller.

1896. *Evotomys glareolus* Barrett-Hamilton, The Zoologist, 3rd ser., xx, p. 98, March, 1896 (Jersey, Channel Islands).

1908. *Evotomys cæsarius* Miller, Ann. and Mag. Nat. Hist., 8th ser., i, p. 195, February, 1908. Type in British Museum.

1910. *Evotomys cæsarius* Trouessart, Faune Mamm. d'Europe, p. 169.

Type locality.—St. Helier, Jersey, Channel Islands.

Geographical distribution.—Known only from the island of Jersey, Channel Islands.

Diagnosis.—General size as in the other large European forms, but tail distinctly less than half as long as head and body, and ear unusually shortened; colour dark and rather dull; essentially no line of demarcation on sides; skull larger and more massive than in any of the Continental members of the genus, *E. rufocanus* not excepted.

Colour.—Winter pelage: upper parts a rich, dark, reddish brown, approaching the cinnamon-rufous of Ridgway, but not so vivid, the sides of body and outer surface of fore leg lighter and suffused with dull buff, though not sufficiently to produce any marked contrast with back; underparts a clear rich buff (between the buff and cream-buff of Ridgway), the line of demarcation along sides ill-defined; tail sharply and conspicuously bicolor, blackish above, concolor with belly below; feet a dusky grey above, rather dark brown on furred portion of sole. Summer pelage: red area restricted to back, and noticeably browner and

duller than in winter, the exact shade nearly hazel ; sides broccoli-brown, in rather strong contrast with back, but fading insensibly into the dull buff of underparts. Tail and feet as in winter.

Skull.—The skull is larger than that of any of the other European *Evotomys.** In form it differs from the others in its greater depth, more convex dorsal profile, and especially in the greater angle at which the nasals are bent downward. In the last character it is approached by *E. skomerensis ;* but the dorsal surface of brain-case is not flattened as in the Skomer vole. Interorbital region wide, not tending to assume a cylindrical form as in *E. rufocanus*, the lateral ridges noticeable in old age but remaining wide apart, with a broad trough-like median groove. Brain-case relatively shorter and broader than in the Continental species, but less ridged and angular than in *E. skomerensis.* Postorbital processes rather large, but less *Microtus*-like than in *E. rufocanus* and with no trace of a ridge extending obliquely backward toward parietal such as occurs in *E. skomerensis.* Nasals about as long as diastema, moderately spatulate in outline. Rostrum more robust than in any of the other European species ; incisive foramina normal. Auditory bullæ large, not peculiar in form. Zygomata not very abruptly spreading, the median portion of the two arches parallel.

Teeth.—Except for their larger size the teeth are essentially as in *Evotomys glareolus.* Third upper molar with third inner re-entrant angle normally present (see Table, p. 631). Anterior loop of m_1 very short.

Measurements.—External measurements of type (not fully adult male) : head and body, 96 ; tail, 49 ; hind foot, 18 ; ear from meatus, 11. Average and extremes of ten adults : head and body, 111·5 (107–115) ; tail, 50·9 (48–58) ; hind foot, 19·3 (18·5–20) ; ear from meatus, 11·4 (11–12). For cranial measurements see Table, p. 657.

Specimens examined.—Eighteen, all from the island of Jersey.

2 ♂.	St. Helier, Jersey.	G. Barrett-Hamilton (c & p).	3. 2. 11. 1–2. (3. 2. 11. 2. *Type* of species.)
5 ♂, 2 ♀.	Trinity, Jersey. (*R. H. Bunting.*)	O. Thomas (p).	8. 9. 2. 12–17.

EVOTOMYS RUTILUS Pallas.

1778. *Mus rutilus* Pallas, Nov. Spec. Quadr. Glir. Ord., p. 246.
1874. *Evotomys rutilus* Coues, Proc. Acad. Nat. Sci., Philadelphia, p. 187.
1900. *Evotomys rutilus* Miller, Proc. Washington Acad. Sci., II, p. 91, July 26, 1900.
1910. *Evotomys rutilus* Trouessart, Faune Mamm. d'Europe, p. 169.

Type locality.—Siberia east of the Obi.

Geographical distribution.—Arctic Asia and Europe, south in Norway to Tromsö, and in Sweden to Norbotten.

* With the possible exception of *E. glareolus hallucalis*, adults of which have not been examined.

Diagnosis.—Size medium (hind foot about 18 mm. ; condylo-basal length of skull, 25 mm.) ; tail noticeably less than half as long as head and body, very densely haired, its pencil at least one-quarter as long as vertebræ ; dorsal area clear bright chestnut, sharply but not conspicuously contrasted with colour of sides.

Colour.—Dorsal stripe a clear bright reddish brown approaching the chestnut of Ridgway, faintly darkened by a slight admixture of black-tipped hairs. Sides and face ochraceous-buff. Underparts cream-colour or dull whitish, darkened by the slate-grey bases of the hairs, which show through irregularly at surface. Feet whitish. Ear concolor with dorsal stripe. Tail sharply bicolor, brownish tinged with red above, dirty white below.

Skull.—In general the skull resembles that of *Evotomys glareolus*. Brain-case shorter and more squarish in outline when viewed from above, its upper surface, together with that of rather wide interorbital region somewhat flattened. Postorbital processes obsolete. Palate and mesopterygoid space relatively narrower than in *E. glareolus ;* posterior termination of palate usually not an entire-edged shelf, since the lateral groove on each side habitually opens freely into posterior nares, thus isolating median portion of shelf from the outer extremities adjoining alveoli.

Teeth.—Molars relatively smaller and weaker than in *Evotomys glareolus*. Enamel pattern essentially as in *E. glareolus* but re-entrant angles tending to be deeper, those of the opposite sides more conspicuously alternating, and salient angles more acute, so that inner triangles of maxillary teeth seldom if ever assume a circular outline. Anterior outer re-entrant angle of m^3 fully as deep as second, the anterior portion of the tooth therefore never assuming the *Alticola*-like aspect characteristic of that region in *E. glareolus ;* inner side of m^3 always with three deep sub-equal re-entrant angles. Second lower molar nearly or quite divided into four alternating closed triangles and a posterior closed loop ; m_3 showing a decided tendency to assume a similar form owing to the depth and distinct alternation of its re-entrant angles.

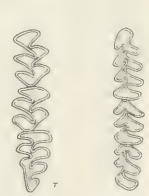

FIG. 126.

Evotomys rutilus. Enamel pattern. × 5.

Measurements.—External measurements of an adult from Karesuando, Sweden (from well-made skin) : head and body, 98 ; tail, 23 ; pencil, 12 ; hind foot, 18. Adult from Lappmark, Sweden (no exact locality) : hind foot, 17. For cranial measurements see Table, p. 657.

Specimens examined.—Seventeen, from the following localities :—
NORWAY : Sydvaranger, 3 (U.S.N.M.) ; Porsanger, 2 (U.S.N.M.).
SWEDEN : Lapland, no exact locality, 7 (B.M. and U.S.N.M.) ; Torneå, Lappmark, 3 (B.M. and U.S.N.M. ; Karesuando, Norbotten, 2 (U.S.N.M.).

Remarks.—Externally *Evotomys rutilus* is distinguishable from the other European members of the genus by its short, abundantly-haired tail, and by the bright colour of its dorsal area. The weak molar rows and the peculiarities of the third upper molar are also diagnostic. Notwithstanding the weakness of the teeth the pattern of the enamel folding is characterized by unusually definite angularity and general firmness of line.

1.	Torneå, Lapland.	Prof. Sundevall (P).	45. 10. 25. 9.
2.	Lapland.	Prof. Sundevall (P).	49. 11. 1. 7–8.
skull.	Varanger Fjord, Finmark.	Dr. R. Collett (P).	84. 10. 31. 5.

EVOTOMYS RUFOCANUS Sundevall.

1846. *Hypudæus rufocanus* Sundevall, Öfversigt af Köngl. Vetensk. Akad. Förhandl., III, p. 122.

1897. *Evotomys rufocanus* Bailey, Proc. Biol. Soc., Washington, XI, p. 122, May 13, 1897.

1900. *Evotomys rufocanus* Miller, Proc. Washington Acad. Sci., II, p. 89, July 26, 1900.

1910. *Evotomys* (*Craseomys*) *rufocanus* Trouessart, Faune Mamm. d'Europe, p. 173.

Type locality.—Lappmark, Sweden.

Geographical distribution.—Northern Europe, south in the mountains of Norway to Dovre, east into Asia.

Diagnosis.—Form essentially as in *Evotomys glareolus*, neither tail nor ear shortened; size large, as in *E. cæsarius* (hind foot, 18 to 19, condylobasal length of skull, 26·6 to 27·6 mm.); skull and teeth heavy, the upper molars with salient angles more pointed than in the other European members of the genus, *E. rutilus* excepted; m^3 normally with only two re-entrant angles on inner side; dorsal stripe narrow, conspicuously contrasted with grey of sides.

Colour.—Dorsal stripe well defined, narrow, extending from between eyes nearly to base of tail. Its colour is dark but rather bright, usually intermediate between hazel and cinnamon-rufous, inconspicuously sprinkled with black-tipped hairs. Sides a clear light grey formed by an intimate blending of hair-brown, whitish, black, and slate-colour. Whole underparts soiled buffy white, irregularly dulled by the slate-grey under colour. Cheeks and muzzle similar to sides but slightly darker. Ear like dorsal stripe. Feet dirty white. Tail sharply bicolor, brownish above, dirty white below. In immature specimens the colour is dull, the dorsal stripe bister scarcely tinged with red, the sides less conspicuously grey.

Skull.—The skull exceeds in size and massiveness that of any of the forms of *Evotomys glareolus*, in this respect essentially agreeing with that of *E. cæsarius*. Interorbital region narrower and more cylindrical than in any of the related species, zygomata heavier and more abruptly and conspicuously expanded in front

of middle, and postorbital processes tending to spread laterally along posterior border of orbit as in *Microtus* rather than to assume the bluntly peg-like form characteristic of *Evotomys*. Brain-case rather long, the occipital region extended backward by the unusually broad interparietal. Basioccipital narrow as in *E. glareolus*, not widened as in the large *E. cæsarius*, its width

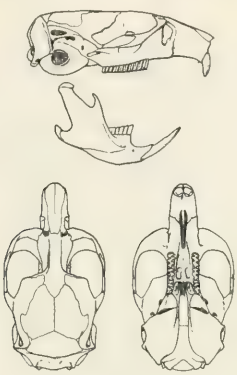

FIG. 127.
Evotomys rufocanus. Nat. size.

along anterior suture equal to about one-third length from suture to foramen magnum. Auditory bullæ rather large, slightly more narrowed antero-internally than in *E. glareolus*. Palate rather narrow but not peculiar in form. Anteorbital foramina relatively smaller (narrower) than in any of the other European members of the genus. Mandible without special peculiarities.

Teeth.—Relatively to size of skull the teeth are larger and heavier than in the other European members of the genus, a peculiarity which is to the eye exaggerated by the contrast with narrow palate. The enamel pattern of the molars agrees with that of *Evotomys glareolus* in number and arrangement of the elements; m^3 normally with only two re-entrant angles on inner side (see Table, p. 631), and with first outer re-entrant angle tending to be deep, as in *E. rutilus*. It is peculiar, however, in a certain tendency to acuteness of the salient angles, a character especially noticeable in not fully adult individuals, and in the constancy with the triangles of all three upper molars and of m_1 become completely closed. Anterior loop of m_1 with inner re-entrant angle relatively deeper

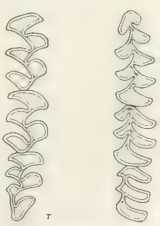

FIG. 128.
Evotomys rufocanus.
Enamel pattern. × 5.

CRANIAL MEASUREMENTS OF *EVOTOMYS GLAREOLUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Occipital breadth.	Occipital depth (median).	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
E. glareolus suecicus.													
Norway: Eggedal	115340	♂	24·0	13·8	3·8	11·0	6·8	6·6	7·0	14·4	5·2	4·8	Molar roots long.
,,	115349	♂	24·2	13·6	4·0	11·2	6·2	7·0	7·0	14·2	4·8	4·8	,, ,,
,,	115357	♂	23·4	13·0	3·8	11·0	6·0	7·0	7·0	14·2	5·0	5·0	,, moderate.
,,	115363	♂	23·8	13·4	4·0	11·2	6·4	7·0	7·2	14·2	4·8	4·8	,, long.
,,	115337	♀	24·0	13·6	3·8	11·0	6·2	7·2	7·0	14·0	5·0	5·0	,, moderate.
,,	115338	♀	23·6	13·4	3·6	11·0	6·2	7·2	7·0	14·2	5·0	5·0	,, long.
,,	115344	♀	24·0	13·4	3·8	11·4	6·6	7·2	7·0	14·6	5·0	4·8	,, moderate.
Asker	142600		24·0	13·6	4·0	11·6	6·2	7·4	7·0	14·8	4·8	4·8	,, long.
Sweden: Upsala	85046*	♀	—	—	3·8	—	—	7·0	6·8	14·2	5·2	5·0	,, short.
E. glareolus glareolus.													
Denmark: Hilleröd, Zealand	98. 6. 7. 13	♂	23·4	13·2	4·0	11 2	6·0	7·0	6·8	13·8	5·2	5·0	,, moderate.
,, ,,	98. 6. 7. 15	♀	23·2	13·0	4·0	11·2	6·2	7·2	6·8	14·4	5·2	5·0	,, short.
,, ,,	98. 6. 7. 16	♀	23·0	13·0	4·0	10·8	6·0	7·0	6·8	14·0	5·0	5·0	,, ,,
,, ,,	98. 6. 7. 17	♀	23·4	13·2	4·0	11·2	6·2	6·8	6·6	13·8	5·2	5·0	,, ,,
Nystad, Lolland	141689	♂	24·2	13·4	4·0	11·8	6·2	7·2	7·0	14·6	5·2	5·2	,, long.
Belgium: Maredsous, Liége	8. 10. 18. 2	♂	24·4	13±	4·0	11·8	6·2	7·0	6·8	15·0	5·2	5·4	,, ,,
,, ,,	8. 10. 18. 6	♀	23·2	13·2	4·0	11·4	5·8	6·6	6·2	14·2	5·2	5·2	,, short.
Waremme ,,	86027	♂	23·2	13·2	3·8	11·8	6·4	6·8	6·8	14·2	5·0	5·0	,, long.
,, ,,	86047	♀	23·6	12·8	3·6	11·2	6·2	7·0	6·8	14·2	5·2	5·0	,, moderate.

France: Guines, Pas-de-Calais .	94. 6. 6. 16	♂	23·0	—	4·0	11·8	6·2	6·6	6·8	14·0	5·4	5·2	Molar roots moderate.
,, ,, .	94. 6. 6. 17	♀	24·6	13·2	4·0	11·4	6·4	7·4	7·0	15·2	5·6	5·4	,, short.
Boulogne ,, .	98. 1. 9. 19	♀	24·0	13·0	3·8	11·0	6·4	7·4	6·8	14·8	5·6	5·6	,, long.
,, ,, .	98. 1. 9. 20	♀	24·0	13·0	4·0	11·2	6·2	7·0	6·8	14·6	5·6	5·6	,, moderate.
Dinan, Côtes-du-Nord .	11. 1. 2. 43	♂	23·4	13·0	3·8	11·2	6·2	7·0	6·6	14·2	5·4	5·2	,, ,,
,, ,, .	—	♂	23·0	13·0	3·8	11·0	6·2	7·0	6·6	14·0	5·2	5·2	,, ,,
Germany: Brunswick . . .	85310	♂	23·6	12·4	3·8	11·0	6·0	7·0	6·8	13·0	5·2	5·0	,, short.
,, . . .	85312	♂	23·2	12·8	4·0	11·2	6·4	6·6	6·6	13·6	4·6	4·4	,, long.
,, . . .	85321	♀	24·0	13·6	3·6	—	—	6·8	7·2	13·8	5·0	5·2	,, moderate.
,, . . .	85322	♀	24·2	13·4	3·8	11·2	6·6	7·4	7·2	14·6	5·4	5·2	,, short.
,, . . .	11. 1. 2. 45	♀	22·4	13·0	3·8	11·0	—	6±	6·4	13·6	5·0	5·0	,, ,,
Mäuseklippe, Harz Mts.	112918	♂	23·6	12·8	3·8	11·2	5·8	7·2	6·8	14·4	5·2	5·0	,, ,,
Ingelheim, Rheinhessen	8. 11. 2. 46	♂	24·6	14·0	3·8	11·4	6·2	7·2	7·2	14·6	5·2	5·2	,, moderate.
,, ,,	8. 11. 2. 48	♀	24·2	13·6	4·0	11·0	6·0	7·0	6·6	14·2	5·4	5·2	,, long.
,, ,,	8. 11. 2. 49	♀	24·2	13·8	3·8	11·0	6·2	6·8	6·8	14·4	5·2	5·0	,, short.
E. glareolus istericus.													
Germany: Marxheim, Bavaria .	153065	♂	23·2	13·0	4·0	11·0	6·2	6·8	6·6	14·0	5·2	5·2	,, ,,
,, ,, .	153066	♂	23·0	13·2	4·0	11·0	6·2	6·4	6·4	13·4	5·4	5·2	,, ,,
,, ,, .	153067	♂	23·0	13·4	3·8	11·0	6·0	6·6	6·8	14·2	5·4	5·2	,, ,,
,, ,, .	153068	♂	23·8	13·2	3·8	11·2	6·0	7·0	6·8	14·0	5·2	5·0	,, moderate.
,, ,, .	153070	♂	22·6	13·0	4·0	11·0	6·2	6·2	6·4	13·6	5·2	5·0	,, ,,
,, ,, .	153071	♂	22·2	13·2	4·0	11·2	6·4	6·4	6·4	13·4	5·2	5·0	,, ,,
Strass, near Burgheim .	153073		23·0	13·2	3·8	11·4	6·2	6·4	6·4	14·0	5·4	5·2	,, short.
Austria-Hungary: Hatszeg, Hunyad	3. 2. 2. 35	♂	23·6	13·4	4·0	11·4	6·4	6·8	6·8	14·2	5·4	5·2	,, moderate.
,, ,,	3. 2. 2. 38	♂	23·6	13·4	4·0	11·4	6·4	6·8	7·0	14·4	4·8	5·0	,, ,,
,, ,,	3. 2. 2. 41	♂	24·4	13·8	4·0	11·6	6·2	7·2	6·8	15·0	5·6	5·4	,, ,,
,, ,,	3. 2. 2. 43		24·4	13·6	4·0	11·2	6·4	7·0	6·8	15·0	5·6	5·2	,, ,,
,, ,,	3. 2. 2. 44	♀	24·0	13·8	4·0	11·6	6·6	7·2	7·2	15·0	5·2	5·0	,, ,,
Roumania: Bustenari . . .	4. 4. 6. 72*	♂	23·2	13·0	3·8	11·4	6·2	6·6	6·8	14·2	5·0	5·0	,, ,,

* Type.

CRANIAL MEASUREMENTS OF *EVOTOMYS GLAREOLUS*—*continued*.

Locality.	Number.	Sex	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Occipital breadth.	Occipital depth (median).	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
E. glareolus britannicus.													
Scotland: Elgin	11. 1. 3. 209	♂	24·0	14·0	4·2	11·2	6·2	7·2	7·2	14·4	5·4	5·2	Molar roots long.
,,	11. 1. 3. 210		24·0	13·6	3·8	10·8	6·0	7·4	7·2	14·0	5·6	5·4	,, moderate.
Birnie, Morayshire	79. 9. 25. 90	♂	21·2	12·2	3·8	10·4	6·0	5·6	5·6	12·8	5·0	4·8	,, short.
Dalmeney Park, Edinburgh	11. 1. 3. 235	♂	21·2	12·4	3·8	10·6	6·0	5·8	5·8	13·4	5·0	5·0	,, ,,
England: Northenden, Cheshire	11. 1. 3. 237	♀	23·2	13±	3·8	10±	6·0	6·8	6·6	14·2	5·2	5·0	,, long.
Anglesey	11. 1. 3. 234	♂	22·0	12·8	3·8	10·8	—	6·4	6·2	13·6	5·0	5·0	,, ,,
,,	109 Coward	♀	22·4	13·0	3 6	10·8	—	—	6·4	13·8	5·0	5·0	,, moderate.
Kingston-on-Thames	C. H. B. Grant, 204	♀	21·8	—	3·8	11·0	6·2	6·4	6·4	13·6	5·0	4·8	,, ,,
Surrey	11. 1. 3. 218	♂	24·2	13·8	4·0	11·6	6·4	7·4	7·2	14·0	5·4	5·2	,, long.
,,	A. H. Bishop, 16	♂	23·6	13·2	4·0	11·4	6·4	7·0	6·8	14·2	5·2	5·2	,, ,,
Swansea, Glamorganshire	11. 1. 3. 233	♂	23·8	13·6	4·0	11·2	6·0	—	7·0	14·2	5·4	5·2	,, ,,
Somerset	11. 1. 3. 226	♀	22·6	13·0	3·6	11·0	6·4	6·2	6·4	13·4	5·0	4·8	,, moderate.
Devonshire	—	♂	22·8	13·0	3·8	11·0	6·2	6·8	6·8	13·2	4·8	5·0	,, long.
Basingstoke, Hampshire	7. 7. 7. 2944*	♀	22·6	13·0	3·8	11·0	6·0	6·6	6·4	13·6	5·0	4·8	,, moderate.
Isle of Wight	11. 1. 3. 224	♀	24·0	13·0	3·8	11·2	6·0	7·0	7·0	14·2	5·4	5·2	,, ,,
,,	11. 1. 3. 222	♂	24·0	13·0	3·8	11·6	6·0	7·2	6·8	14·8	5·6	5·4	,, long.
,,	11. 1. 3. 225		23·8	13·8	4·0	11·8	6·4	7·0	7·0	14·6	5·6	5·4	,, short.

E. glareolus nageri.													
France: Chamonix, Haute-Savoie .	124485	♂	25·0	14·2	4·0	12·0	6·6	7·2	7·0	15·0	5·6	5·4	Molar roots moderate.
,, ,, .	124491	♀	25·8	14·6	3·8	12·2	6·4	7·6	7·2	15·8	5·8	5·6	,, ,,
Switzerland: Les Plans, Vaud .	104511	♂	25·6	14·2	3·8	11·8	6·6	7·2	7·2	15·4	5·8	5·6	,, ,,
Zermatt, Valais .	124527	♂	25·2	13·8	4·0	11·8	6·4	7·2	7·4	15·0	5·8	5·4	,, ,,
,, ,, .	124532	♂	25·0	14·0	3·8	12·0	6·4	7·4	7·2	15·0	5·8	5·6	,, short.
,, ,, .	124529	♀	25·2	14·0	3·8	11·8	—	7·4	7·2	15·2	5·6	5·4	,, moderate.
Genthal, Berne. .	Geneva†		25·0	14·2	4·0	11·8	—	—	7·2	15·0	6·2	6·0	,, ,,
Vitznau . . .	124551	♂	25·4	14·4	4·0	11·8	6·4	8·0	7·0	15·4	5·8	5·4	,, ,,
,, . . .	5. 8. 3. 22	♂	26·0	15·0	4·2	12±	—	8·0	7·8	15·4	5·8	5·6	,, ,,
,, . . .	5. 8. 3. 23	♀	25·8	14·8	4·0	12·2	6·6	8·0	7·6	15·6	6·0	5·8	,, ,,
,, . . .	5. 8. 3. 26	♀	25·4	14·2	4·0	12·0	6·8	7·8	7·6	15·0	5 6	5·4	,, ,,
Göschenen, Uri. .	124571	♂	25·4	14·0	3·8	11·8	6·6	8·0	7·0	15·4	6·0	5·8	,, ,,
,, ,, . .	124568	♀	26·0	14·0	3·8	—	6·8	8·0	7·6	16·2	6·0	5·6	,, ,,
,, ,, . .	124569	♀	25·6	13·8	3·8	12·0	6·4	7·8	7·6	15·8	5·6	5·4	,, ,,
,, ,, . .	124573	♀	26·2	14·0	4·0	12·0	6·2	8·0	7·8	16·0	6·0	5·6	,, ,,
Andermatt ,, . .	1676 Mottaz	♂	25·0	14·4	3·8	12·0	6·2	7·0	7·6	15·4	5·2	5·0	,, ,,
,, ,, . .	85702	♂	25·0	13·8	3·8	11·2	6·6	7·2	7·4	15·2	5·4	5·0	,, ,,
,, ,, . .	85704	♂	25·0	13·8	4·0	12·0	6·2	8·0	7·8	14·8	5·2	5·2	,, long.
,, ,, . .	85726		25·8	14±	3·8	12·0	6·6	7·8	7·6	15·0	5·4	5·2	,, moderate.
Locarno, Ticino .	5. 8. 3. 16	♂	25·0	14·0	4·0	11·6	6·4	7·6	7·4	14·4	5·4	5·2	,, short.
Lugano ,, .	1593 Mottaz	♂	25·4	14·4	4·0	12·0	6·8	7·8	7·6	15·2	6·0	5·4	,, ,,
,, ,, .	124599	♂	25·2	14·2	4·0	11·6	6·2	7·8	7·2	15·6	5·8	5·6	,, moderate.
Murgthal, St. Gallen.	123601	♀	25·2	13·8	3·8	12·0	6·4	7·2	7·2	15·6	5·8	5·6	,, ,,
Untervatz, Grisons .	111530	♂	25·0	13·6	3·8	11·8	6·2	7·8	7.4	—	5·6	5·4	
E. glareolus hallucalis.													
Italy: Santa Eufemia d'Aspromonte	6. 8. 4. 9*	♂	25·8	14·2	4·2	—	6·8	7·6	7·4	15·2	6·4	6·0	,, short.

* Type.

† Type of *bicolor* Fatio.

CRANIAL MEASUREMENTS OF *EVOTOMYS GLAREOLUS—continued.*

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Occipital breadth.	Occipital depth (median).	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
E. glareolus vasconiæ.													
France: Montréjeau, Haute-Garonne	86994*	♂	25·0	14·0	4·0	11·6	6·6	7·4	8·0	15·0	5·8	5·6	Molar roots moderate.
Ax-les-Thermes, Ariège	8. 8. 4. 252	♂	25·6	14·0	4·0	11·6	6·8	7·8	7·6	14·8	5·6	5·6	,, ,,
l'Hospitalet ,,	153111	♀	25·2	14·2	4·0	12·0	6·4	7·0	7·0	15·8	5·8	5·8	,, ,,
Porté, Pyrénées-Orientales	153114	♀	25·0	13·8	4·2	12·0	6·8	7·4	7·0	15·2	5·8	5·6	,, ,,
,, ,,	172196	♀	25·8	14·2	4·0	11·8	6·8	8·0	7·8	16·0	5·8	5·6	,, short.
Barèges, Hautes-Pyrénées.	172198	♀	25·8	13·6	3·8	12 0	6·4	—	7·8	15·4	5·4	5·2	,, moderate.
E. glareolus helveticus.													
Switzerland: Chesières, Vaud	1943 Mottaz	♂	24·8	13·8	4·0	11·6	6·4	7·0	7·2	14·6	5·2	5·2	,, long.
,, ,,	2771 ,,	♀	24·8	13·8	3·8	12·0	6·0	7·4	7·2	15·2	5·8	5·8	,, moderate.
Bioux ,,	1507 ,,	♂	23·8	13·8	4·0	11·6	6·6	7·0	7·8	14·0	5·2	5·2	,, short.
,, ,,	1518 ,,	♂	23·8	13·8	4·0	11·4	6 0	6·6	7·0	14·2	5·4	5·2	,, moderate.
,, ,,	1472 ,,	♀	25·0	14·0	4·0	11·8	6·4	7·4	7·4	15·2	5·6	5·4	,, ,,
,, ,,	1521 ,,	♀	24·6	14·0	3·8	11·8	6·2	7·2	7·2	15·2	5·4	5·2	,, ,,
St. Cergues, Vaud	566 ,,	♂	25·2	—	3·8	11·8	6·4	7·8	7·4	15·0	5·6	5·4	,, short.
,, ,,	124443	♂	24·0	13·8	4·0	11·2	6·0	7·0	7·0	14·6	5·6	5·4	,, ,,
,, ,,	124431	♀	25·2	13·8	3·8	12·0	6·8	7·4	7·2	15·4	5·8	5·8	,, moderate.

Switzerland: Geneva . . .	124371	♀	24·8	13·8	4·0	11·6	6·4	7·0	7·2	15·2	5·2	5·0	Molar roots long.
,, . . .	124372	♀	23·6	13·2	3·8	11·0	6·2	6·8	6·8	14·4	5·0	4·8	,, ,,
,, . . .	124374	♀	23·4	13·4	3·8	11·0	6·0	6·8	6·8	14·2	4·8	4·8	,, moderate
,, . . .	124378	♀	25·2	13·8	3·8	11·4	6·2	7·2	7·2	15·2	5·6	5·4	,, long.
France: Montauban, Haute-Savoie	2. 6. 7. 1*	♂	23·8	13·2	3·8	11·2	6·2	7·0	6·8	14·4	5·8	5·4	,, short.
,, ,,	105709	♂	24·6	13·8	3·8	11·2	6·2	7·4	7·0	15·0	5·6	5·6	,, ,,
,, ,,	105720	♀	24·6	13·6	3·8	11·4	6·6	7·0	6·8	14·8	5·6	5·4	,, long.
Cranves-Sales ,,	5. 11. 18. 34	♂	23·8	13·0	4·0	11·4	6·2	6·8	6·4	14·2	5·4	5·2	,, moderate.
,, ,,	5. 11. 18. 36	♂	24·4	14·0	4·0	11·6	6·2	7·2	7·2	14·2	5·2	5·2	,, ,,
,, ,,	5. 11. 18. 37	♂	23·0	13·0	3·8	11·2	6·4	6·2	6·8	14·0	5·2	5·0	,, ,,
,, ,,	5. 11. 18. 38	♂	24·0	13·0	4·0	11·2	6·2	6·8	6·8	14·2	5·4	5·4	,, long.
,, ,,	153515	♂	24·8	14·2	4·0	11·8	6·4	7·2	7·2	14·8	5·6	5·6	,, moderate.
,, ,,	153518	♂	23·8	13·2	3·6	11·4	6·2	7·2	6·8	14·8	5·4	5·2	,, ,,
,, ,,	153520	♂	25·0	14·0	4·2	12·0	6·4	7·2	7·0	15·2	5·8	5·8	,, short.
,, ,,	5. 11. 18. 39	♀	24·0	13·0	3·8	11·4	6·2	7·0	6·6	14·6	5·6	5·4	,, long.
,, ,,	5. 11. 18. 40	♀	24·8	13·8	4·0	11·8	6·0	7·2	7·0	15·0	5·6	5·2	,, moderate.
,, ,,	5. 11. 18. 41	♀	24·6	—	4·0	11·8	6·2	7·6	6·8	15·0	6·0	5·4	,, short.
,, ,,	5. 11. 18. 43	♀	25·4	14·2	4·0	11·8	6·6	7·6	7·6	15·0	6·0	6·0	,, ,,
Barcelonnette, Basses-Alpes	103362	♂	25·6	14·2	3·8	12·2	6·6	7·4	7·4	15·4	5·4	5·4	,, ,,
,, ,,	103363	♂	25·8	14·0	4·0	12·0	6·8	7·6	8·0	15·2	5·6	5·6	,, ,,
,, ,,	103373	♂	25·6	14·0	4·2	11·8	6·2	7·6	7·0	15·8	5·8	5·6	,, moderate.
,, ,,	5. 8. 5. 3	♂	25·0	14·4	4·0	11·8	6·4	7·4	7·2	15·0	5·4	5·0	,, ,,
,, ,,	5. 8. 5. 4	♀	25·8	14·0	3·8	11·4	6·2	8·0	7·6	15·2	5·8	5·2	,, ,,
,, ,,	103351	♀	25·2	14·0	3·6	11·2	6·2	7·4	7·0	15·0	5·6	5·4	,, short.
,, ,,	103354	♀	25·6	14·2	3·8	11·6	6·2	8·0	7·4	15·6	5·6	5·4	,, moderate.

* Type.

CRANIAL MEASUREMENTS OF *EVOTOMYS SKOMERENSIS*, *E. CAESARIUS*, *E. RUFOCANUS* AND *E. RUTILUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Occipital breadth.	Occipital depth (median).	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
E. skomerensis.													
Wales: Skomer Island . . .	3. 7. 4. 1	♂	25·4	15·0	4·0	12·4	7·0	8·0	7·2	16·0	5·8	5·6	Molar roots short.
,, . . .	3. 7. 4. 2	♂	25·0	15·0	4·0	12·6	7·0	7·8	7·0	16·0	5·8	5·6	,, moderate.
,, . . .	3. 7. 4. 3*	♂	25·2	14·6	4·0	12·6	6·8	8·0	7·2	15·8	5·8	5·6	,, ,,
,, . . .	3. 7. 4. 4	♂	25·8	14·6	4·0	12·4	7·0	8·2	7·2	15·8	5·6	5·6	,, ,,
,, . . .	3. 7. 4. 5	♂	25·4	14·8	4·0	12·0	7·0	7·6	6·8	16·0	5·8	5·6	,, ,,
,, . . .	3. 7. 4. 7	♂	25·6	15·0	4·0	12·4	7·0	8·2	7·2	16·0	5·8	5·8	,, long.
,, . . .	3. 7. 4. 6	♀	25·6	15·0	4·0	12·4	7·0	8·2	7·0	16·0	6·0	5·8	,, moderate.
,, . . .	11. 1. 3. 266		25·6	14·8	4·0	12·2	6·8	8·2	7·0	15·6	5·6	5·6	,, ,,
,, . . .	11. 2. 3. 265		24·8	14·4	4·0	12·0	6·6	7·8	6·8	15·8	6·0	5·8	,, ,,
,, . . .	123389	♀	25·4	14·6	4·0	12·0	6·4	8·2	7·2	16·4	5·8	5·4	,, long.
,, . . .	153115	♂	25·2	14·2	4·2	12·0	7·0	8·0	7·2	15·6	5·8	5·8	,, moderate.
,, . . .	123419	♀	25·2	—	4·0	12·2	6·6	8·0	7·2	16·2	5·8	5·8	,, long.
,, . . .	123420	♀	25·0	15·0	4·0	12·4	6·8	7·8	7·2	16·0	5·8	5·8	,, ,,

E. cæsarius.													
Channel Islands: St. Helier, Jersey	3. 2. 11. 1	♂	—	14·0	4·0	—	—	7·0	7·0	15·2	6·2	6·0	Molar roots short.
,, ,,	3. 2. 11. 2*	♂	25·6	14·0	4·0	11·6	7·0	7·0	7·2	15·4	6·2	6·0	,, ,,
Trinity ,,	Bunting 7	♂	27·4	16·0	4·2	12·6	7·2	7·8	8·0	16·6	6·2	6·4	,, long.
,, ,,	153128	♂	26·2	15·2	4·0	11·8	6·8	7·6	7·6	16·4	6·2	6·2	,, ,,
,, ,,	—	♂	25·8	15·0	4·0	12·0	6·6	7·2	7·4	16·0	6·2	6·2	,, moderate.
,, ,,	153121	♂	26±	15·4	4·0	12·2	—	7·8	7·8	16·0	6·2	6·2	,, ,,
,, ,,	—	♀	25·0	14·0	4·0	11·6	6·8	8·0	7·6	16·0	6·0	6·0	,, long.
,, ,,	153124	♀	26·8	14·8	4·0	11·8	6·8	8·0	8·0	17·4	6·4	6·4	,, moderate.
,, ,,	153130	♀	27·2	16·2	4·0	13·0	7·0	7·8	7·8	17·2	6·6	6·6	,, long.
,, ,,	153123	♂	25·2	15·0	4·0	11·6	6·6	7·6	7·0	15·6	6·2	6·0	,, moderate.
E. rufocanus.													
Norway: Hyllingen, Trondhjem .	—	♀	27·0	15·0	3·8	12·6	7·0	7·8	7·8	16·8	6·8	6·2	,, ,,
Tana	101411		27·6	15·4	3·8	12·8	6·8	—	8·0	16·8	6·4	6·0	,, long.
Porsanger . . .	6554 Merriam		27·4±	15·2	4·2	—	—	7·6	7·6	16·8	6·8	6·0	,, ,,
Sweden: Karesuando, Norbotten .	90. 8. 1. 15	♂	27·2	16±	4·2	12·6	7·0	7·6	7·6	17·0	6·8	6·2	,, moderate.
,, ,, .	122103	♂	26·8	15·0	4·0	11·6	6·8	7·8	7·2	16·4	6·6	6·2	,, ,,
Torneå, Lappmark . .	6556 Merriam	♂	26·6	15·0	4·0	12·2	7·0	8·0	7·8	16·8	6·6	6·2	,, ,,
E. rutilus.													
Lapland: no exact locality . .	49. 11. 1. 24		—	—	4·2	—	—	7·8	7·8	14·6	4·8	4·8	,, short.
Sudvaranger, Finmarken.	6555 Merriam		25·0	14·2	4·0	11·8	7·0	7·8	7·8	15·0	5·0	5·0	,, moderate.

* Type.

than in *E. glareolus*, so that main axis of loop appears to curve inward instead of outward. Roots of molars developing later in life than in the other European species, the position of the inner extremity of upper teeth indicated by an evident capsule. Basal portion of m_3 usually well outlined on inner surface of mandible.

Measurements.—External measurements of adult male from Lappmark, Sweden: head and body, 114; tail, 37; hind foot (dry), 18·4. Adult from Kvickjock, Sweden (well-made skin): head and body, 110; tail, 40; hind foot, 18. For cranial measurements see Table, p. 657.

Specimens examined.—Twenty-four, from the following localities:—

NORWAY: Varangerfjord, 1; Sudvaranger, 1 (U.S.N.M.); Stabursnaes, Porsanger, 2 (B.M. and U.S.N.M.); Kishand, Porsanger, 1; Porsanger, 1 (U.S.N.M.); Mölmen, Kristiansamt, 1; Sundal Fjeld, 1; Hyllingen, Trondhjem, 1; Tanen, Finnmarken, 2 (U.S.N.M.).

SWEDEN: Karesuando, Norbotten, 3 (B.M. and U.S.N.M.); Lappmark (no exact locality), 1; Tornea, Lappmark, 2 (U.S.N.M.); Kvickjock, Norbotten, 6 (B.M. and U.S.N.M); no exact locality, 1.

Remarks.—Evotomys rufocanus is so readily distinguishable from the other European members of the genus as to require no special comparison. So different is the animal from the better known species that it has been made the type of a special subgenus *Crascomys*. The discovery of additional species, notably *Evotomys cæsarius*, intermediate in character between true *Evotomys* and *Crascomys*, and the fuller comprehension of the dental peculiarities of *Evotomys rutilus*, make such a division of the genus *Evotomys* appear to be no longer warranted.

1 skull.	Varangerfjord, Finmark, Norway.	Dr. R. Collett (P).	84. 10. 31. 4–5.
♂.	Stabursnaes, Porsanger.	Dr. R. Collett (P).	84. 10. 31. 7.
♂ skull.	Kishand, Porsanger.	Dr. R. Collett (P).	84. 10. 31. 6.
♂.	Mölmen, Kristiansamt.	R. J. Cuninghame (C & P).	98. 5. 2. 5.
	Sundal Fjeld.	E. Lort Phillips (C & P).	94. 10. 22. 2.
♀.	Hyllingen, Trondhjem.	G. Barrett-Hamilton (P).	11. 1. 2. 114.
♂.	Karesuando, Norbotten, Sweden.	Stockholm Museum (E).	90. 8. 1. 15.
1.	Kvickjock, Norbotten.	Prof. Sundevall (P).	49. 11. 1. 11.
♂.	Lappmark. (*G. Kolthoff.*)	Lord Lilford (P).	11. 1. 1. 153.
1.	Sweden.	Stockholm Museum (E).	46. 6. 2. 70.

GENUS **MICROTUS** Schrank.

(Synonymy under sub-genera.)

Geographical distribution.—Northern portions of northern hemisphere south in America to southern Mexico and in Europe to the Mediterranean coast.

Characters.—Bony palate terminating posteriorly in a sloping median ridge and two lateral pits; lower incisor with root extending to outer side of molar-roots, rising high above level of cutting surface of molars, and forming a noticeable protuberance on outer surface of ascending portion of mandible at base of articular process; molars permanently rootless, growing continuously from a persistent pulp and not wearing away in old age; pattern of enamel folding characterized by acuteness of salient angles; mammæ, 8; plantar tubercles, 6; neither fur, external form, nor skull modified for aquatic or subterranean life.

Remarks.—The genus *Microtus* as here understood, restricted to the species with normal skull, palate and enamel folding, 8 mammæ, 6 plantar tubercles, and no special modifications of external form, is the largest and most widely distributed group in the sub-family. About 100 species are now recognized, a number which will be materially increased as the fauna of the interior of Asia becomes better known. Fifteen species are here recognized as occurring in western Europe. Among them are represented two sub-genera.

Sub-Genus **MICROTUS** Schrank.

1798. *Microtus* Schrank, Fauna Boica, I, p. 72 (*Microtus terrestris* Schrank = *Mus arvalis* Pallas).

1817. *Mynomes* Rafinesque, Amer. Monthly Magazine, II, p. 45 (*Mynomes pratensis* Rafinesque = *Arvicola pennsylvanicus* Ord).

1836. *Hemiotomys* de Sélys-Longchamps, Essai monographique sur les Campagnols des environs de Liége, p. 7. Part (*arvalis* and *terrestris* = *scherman*).

1857. *Paludicola* Blasius, Säugethiere Deutschlands, p. 333. Part (*amphibius* = *scherman*, *nivalis* and *ratticeps*). Not of Wagler, 1830.

1857. *Agricola* Blasius, Säugethiere Deutschlands, p. 334 (*agrestis*).

1867. *Praticola* Fatio, Les Campagnols du Bassin du Léman, p. 34 (included *amphibius* = *scherman*, *nivalis*, *arvalis*, *ratticeps* and *campestris* = *agrestis*). Not of Swainson, 1837.

1867. *Sylvicola* Fatio, Les Campagnols du Bassin du Léman, p. 63 (*agrestis*). Not of Harris, 1782.

1883. *Microtus* Lataste, Le Naturaliste, II, p. 348.

1890. *Campicola* Schulze, Schriften Naturwiss. Viereins d. Harzes in Wernigerode, V, p. 24. Part (*arvalis*, *subterraneus* and *campestris* = *agrestis*).

1894. *Tetramerodon* Rhoads, Proc. Acad. Nat. Sci., Philadelphia, p. 282 (*Arvicola tetramerus* Rhoads).

1896. *Microtus* Miller, North American Fauna, No. 12, p. 62, July 23, 1896.

1899. *Euarvicola* Acloque, Faune de France, Mammifères, p. 49 (*agrestis*).

Type species.—*Microtus terrestris* Schrank = *Mus arvalis* Pallas.

Geographical distribution.—Northern portions of both hemispheres, south in America to southern Mexico, and in the Old World to Portugal, central Spain, the Mediterranean coast of

France, northern Italy, the central portion of the Balkan Peninsula, Asia Minor and northern India.

Diagnosis.—Principal characters as in the genus ; third upper molar with three re-entrant angles on inner side ; skull with brain-case narrow and high, or broader and more flattened, its surface ridged and angular ; interorbital region narrow, the temporal ridges well developed ; elements of posterior edge of palate well defined.

Remarks.—The sub-genus *Microtus* contains most of the members of the genus. Twelve species are now known to occur in western Europe.

KEY TO EUROPEAN FORMS OF THE SUB-GENUS *MICROTUS*.

Second upper molar with two closed triangles on inner side ..... *M. agrestis*, p. 662.
Condylobasal length of skull in largest individuals 27 to 28·4 mm.
First upper molar with third inner triangle usually present; underparts heavily washed with wood-brown (Hebrides) ..... *M. a. exsul*, p. 669.
First upper molar with third inner triangle usually absent; underparts slightly or not washed with wood-brown.
Brain-case relatively long, the distance from condyle to back of interorbital constriction decidedly greater than zygomatic breadth (Alps and their immediate neighbourhood; marshes near mouth of Rhone) ..... *M. a. levernedii*, p. 671.
Brain-case relatively short, the distance from condyle to back of interorbital constriction about equal to zygomatic breadth (Scandinavia) ..... *M. a. agrestis*, p. 668.
Condylobasal length of skull in largest individuals 24·6 to 26·6 mm.
Auditory bulla small and flattened, its greatest diameter (from paroccipital process to tip of anterior spine) contained about 3½ times in condylobasal length of skull (Portugal and north-western Spain) ..... *M. a. rozianus*, p. 680.
Auditory bulla large and inflated, its greatest diameter contained about 3 times in condylobasal length of skull.
Condylobasal length of skull in largest individuals 25 to 26 mm. (England and southern Scotland) ..... *M. a. hirtus*, p. 673.
Condylobasal length of skull in largest individuals 25·4 to 26·6 mm.
General colour of upper parts darker, usually with decided tinge of russet (Northern and central Scotland) ..... *M. a. neglectus*, p. 675.
General colour of upper parts lighter, usually with no decided tinge of russet (West-central Continental Europe) .... *M. a. bailloni*, p. 672.
Second upper molar with one closed triangle on inner side.
First lower molar with three re-entrant angles on outer side ..... *M. ratticeps*, p. 708.

First lower molar with four or five re-entrant angles on outer side.
Nasals moderately cuneate, their combined breadth posteriorly a little more than half their greatest breadth; diastema noticeably shorter than nasals.
Condylobasal length of skull about 27 mm.; upper tooth-row about 7 mm., the teeth not unusually robust (Central Spain)..... *M. cabreræ*, p. 701.
Condylobasal length of skull about 30 mm.; upper tooth-row about 8 mm., the teeth unusually robust (South-eastern Spain) *M. dentatus*, p. 703.
Nasals strongly cuneate, their combined breadth posteriorly much less than half that anteriorly; diastema usually longer than nasal, never noticeably shorter.
Largest skulls with condylobasal length about 27 to 30 mm.
Rostrum very short and deep (distance from front of zygoma to tip of nasal less than depth of rostrum through posterior extremity of nasal); nasal forming very conspicuous angle (about 34°) with dorsal surface of interorbital region (Southern Hungary)..... *M. angularis*, p. 706.
Rostrum normal in form (distance from front of zygoma to tip of nasal greater than depth of rostrum through posterior extremity of nasal); nasal not forming very conspicuous angle (about 20°) with dorsal surface of interorbital region.
Auditory bullæ unusually large; upper molars with osteodentine spaces reduced (Thessaly)..... *M. hartingi*, p. 704.
Auditory bullæ not unusually large; upper molars with osteodentine spaces of normal width.
General form of skull narrow and *agrestis*-like; median ridge of posterior termination of bony palate without evident groove along suture; zygomata not conspicuously expanded at middle; underparts pale clear grey (Channel Islands). *M. sarnius*, p. 700.
General form of skull broad, not *agrestis*-like; median ridge of posterior termination of bony palate with evident groove along suture; zygomata conspicuously expanded at middle in adults; underparts brownish buff or buffy grey (Orkney Islands).
Brain-case not flattened, the ratio of occipital depth to width about 57; condylobasal length of largest skulls 28 to 29·6 mm. (South Orkney Islands)..... *M. orcadensis*, p. 694.
Brain-case flattened, the ratio of occipital depth to width about 53; condylobasal length of

largest skulls 26·6 to 27·6 mm. (North Orkney Islands)..... *M. sandayensis*, p. 696.
First lower molar with anterior outer re-entrant angle obsolete; back decidedly greyish; underparts scarcely tinged with yellowish brown (Sanday Island)..... *M. s. sandayensis*, p. 697.
First lower molar with anterior outer re-entrant angle usually well developed; back not decidedly greyish; underparts strongly washed with yellowish brown (Westray Island)... *M. s. westræ*, p. 698.
Largest skulls with condylobasal length less than 27 mm.
Brain-case with occipital region noticeably flattened; skull in general tending to assume a fossorial aspect (Alps)..... *M. incertus*, p. 690.
Brain-case with occipital region not noticeably flattened; skull in general not tending to assume a fossorial aspect.
Interorbital region much elevated, so that dorsal profile of skull is strongly convex (Asturias and Sierra de Guadarrama)..... *M. asturianus*, p. 693.
Interorbital region low, so that dorsal profile of skull is slightly convex or nearly flat ..... *M. arvalis*, p. 681.
Skull narrow and rounded; brain-case so long that distance from condyle to back of interorbital constriction is greater than zygomatic breadth (Roumania and southern Hungary) ..... *M. a. levis*, p. 687.
Skull broad and rather angular; brain-case so short that distance from condyle to back of interorbital constriction is at most equal to zygomatic breadth.
General colour greyish or brownish, the sides of body not conspicuously buffy (Eastern Germany) *M. a. duplicatus*, p. 686.
General colour a decidedly yellowish brown, the sides of body conspicuously suffused with buff.
Size slightly smaller and colour a little less yellowish (Central Europe)..... *M. a. arvalis*, p. 683.
Size slightly larger and colour a little more yellowish (Pyrenees) ..... *M. a. meridianus*, p. 686.

MICROTUS AGRESTIS Linnæus.

(Synonymy under subspecies.)

Geographical distribution.—Northern and central Europe from northern Scandinavia to the Alps, Pyrenees, Galicia and Portugal, and from England, Scotland and the Hebrides eastward.

Diagnosis.—Size small or medium (hind foot, 17 to 21 mm.; condylobasal length of skull in largest individuals, 24·6 to 28·4 mm.); second upper molar with well developed postero-internal triangle; first lower molar with four re-entrant angles on outer side; skull moderately broad (ratio of zygomatic breadth to condylobasal length ranging from 53 to 60), the intertemporal region developing a distinct ridge with age; length of brain-case measured from interorbital constriction to condyle equal to or greater than zygomatic breadth.

External characters.—General form robust, the neck short and thick, the head large, wide and blunt, the ears inconspicuous; legs short; tail about one-third as long as head and body. Head large, broad posteriorly, tapering slightly to the blunt muzzle; ear scarcely appearing above fur, and extending, when laid forward, barely half-way to eye, its outline evenly rounded; meatal lobe well developed, its height at middle about 3 mm. Eye small, not very prominent, situated distinctly nearer to muzzle than to base of ear, its diameter contained about 3½ times in distance from inner canthus to muzzle. Nostril pad small, not very well defined, divided down middle by a narrow but evident groove continuous with that crossing upper lip; nostril opening almost directly outward, its anterior margin noticeably swollen. Mouth small, the upper teeth very slightly projecting. Fore foot with inner digit reduced to a minute tubercle, whose dorsal surface is mostly covered by the closely appressed, highly arched nail; third and fourth digits sub-equal and longest, fifth extending barely beyond base of fourth, second intermediate between fifth and third; palmar tubercles five, well developed, occupying considerably more than half surface of palm, that at base of thumb is slightly the largest (more than twice as large as thumb itself), the others are sub-equal; surface of palm between tubercles slightly and inconspicuously granular. Hind foot moderately long and slender, the toes relatively short (length of third digit a little less than one-third length of sole); inner digit extending scarcely to base of second, outer slightly beyond base of fourth; second, third and fourth sub-equal; plantar tubercles six, all well developed, occupying distinctly more than half of surface of region in which they lie; with the exception of the sixth which is sub-circular in outline and only about half as large as the others, they are sub-equal in size and all are irregularly pyriform in outline; surface of integument between tubercles finely granular; behind last tubercle the sole is densely covered with short hair. Claws simple, moderately curved, those of hind feet, toe for toe, slightly the longer. Tail extending slightly beyond outstretched hind foot, its annulations pronounced though often somewhat irregular, about 20 to the centimeter at middle; hairs not sufficiently abundant to conceal annulations, but forming an evident though thin pencil, their length usually equal to width of two or three rings. Fur without special peculiarities of

distribution or texture, its quality somewhat harsh and loose. Mammæ : $p\ 2-2$, $i\ 2-2 = 8$.

Skull.—The skull is moderately broad and rather deep, attaining a marked degree of angularity in old age. Dorsal profile moderately convex throughout, the interorbital region usually flattish, the nasals sloping forward at an angle of about 18°. Occiput sufficiently oblique for the condyles to be visible when skull is viewed from above. Ventral profile with no special peculiarities ; contrast between occipital depth and that of rostrum very pronounced. Brain-case oblong, well squared anteriorly by the prominent postorbital processes, its lateral borders nearly parallel except for the break caused by the zygomatic roots ; outer edges of parietals marked in old age by well developed longitudinal ridges which are continuous posteriorly with lambdal crest and which come together abruptly in front to join the interorbital ridge. No trace of sagittal crest ; lambdal crest represented by the outer extremities only. Interparietal large, its area nearly equal to that of parietal, its form somewhat variable, but posterior border usually straight or nearly so, anterior border biconvex with median projection, the outer extremities rather abruptly truncate ; greatest antero-posterior diameter, exclusive of median projection sensibly less than half transverse diameter. Depth of occiput when viewed from behind more than half width, the brain-case rising slightly above occipital level ; paroccipital processes well developed, their tips extending noticeably beyond level of lower lip of foramen magnum, their bases continued upward as conspicuous ridges along suture between occipital and squamosal. Floor of brain-case without special features, the basioccipital with ill-defined median ridge ; width of basioccipital along anterior suture contained about three times in median length. Auditory bullæ large, evenly inflated, without much spongy tissue, the surface smooth and shining ; beak moderately developed, closely applied to outer side of base of pterygoid ; region near meatus slightly flattened. Interorbital region narrow, sub-cylindrical, with distinct temporal ridges which eventually unite to form a definite median crest extending well forward to nasals. Zygomata wide spreading and short, a small portion near middle essentially parallel with main axis of skull ; median expansion evident but not very wide ; anteorbital foramen narrow and high, the plate forming outer

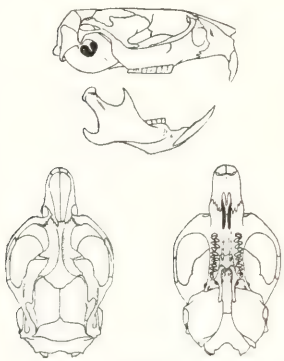

FIG. 129.
Microtus agrestis. Nat. size.

wall of canal rudimentary below, absent above. Rostrum slender, scarcely wider than interorbital region, rather deep proximally but shallow anteriorly, the least depth behind incisors slightly greater than width in same region; nasals broad anteriorly, abruptly narrowed at middle, the posterior termination pointed, blunt, or angular-emarginate, seldom extending behind level of middle of zygomatic root, and usually a little exceeded by nasal branches of premaxillaries; incisive foramina long and narrow, slightly narrower posteriorly than anteriorly, extending from about 3 mm. behind incisors almost or quite to level of molar alveoli. Palate rather narrow (less than twice width of alveolus), marked by two longitudinal grooves continued back from incisive foramina to lateral bridges of posterior border; median posterior ridge and lateral pits well defined, the anterior border of pits on level with first inner re-entrant angle of m^3. Mesopterygoid space narrow, about $2\frac{1}{2}$ times as long as wide, the pterygoids and hamulars straight. Ectopterygoid plate well developed, the ectopterygoid pit large and deep, not encroached on by bulla. Mandible robust, the portion in front of molars short; masseter ridge well developed; coronoid process large, its base broad, its extremity rising to level of condyle and distinctly curved backward; articular process abruptly bent inward at level of base of incisor, the root of which does not as a rule, however, produce any marked swelling on outer side of process; angular process well developed though rather slender, curved strongly outward.

Teeth.—Upper incisors robust, strongly curved, the shaft forming almost exactly half a circle, the root producing a slight protuberance in lower portion of anteorbital foramen, the exposed part of tooth directed downward with a slight backward curve, the anterior face barely visible when skull is viewed from above; section of shaft obscurely triangular with broadly rounded angles, the anterior face longest, the inner face nearly as long as anterior face, the postero-external face noticeably shorter than either of the others; enamel covering entire anterior face and extreme anterior portion of inner face; cutting area rather deeply but simply hollowed, the anterior (enamel) edge entire and nearly straight when viewed from in front, obliquely flattened and with rather abruptly backward-curved extremities when viewed from below, the posterior edge usually with some irregular notches cut by the points of the lower teeth. Lower incisors much less strongly curved than upper incisors, their roots extending into base of articular process of mandible but not producing any noticeable swelling on outer surface; section of shaft much like that of upper incisor, but antero-posterior diameter relatively greater, and

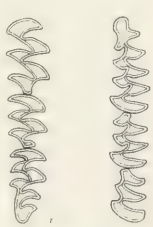

FIG. 130.
Microtus agrestis.
Enamel pattern. × 5.

anterior border more strongly and evenly rounded, so that triangular outline is less evident; distribution of enamel essentially as in upper tooth. Molars moderately large relatively to size of skull, their enamel pattern well defined, with sharp salient and re-entrant angles; upper teeth without noticeable contrasts in length of crowns, but m_1 decidedly longer than either of the succeeding mandibular teeth. First upper molar normally with an anterior transverse loop and four alternating closed triangles; rarely a postero-internal loop similar to that in m^2 may be present;* two re-entrant angles are normally present on each side (a third on inner side when postero-internal loop is present), they are sharply pointed and well defined, their points extending beyond median line of crown, those of outer side slightly narrower and deeper than those of inner side; anterior loop crescentic in outline, its inner limb longer and narrower than outer limb (though its apex does not extend to level of those of inner triangles), its length decidedly less than greatest width of tooth, its main axis oblique to that of tooth-row; inner and outer triangles essentially alike in form, those of inner side slightly the larger; postero-internal loop when fully developed similar to that of m^2, but more often rudimentary. Second upper molar with an anterior transverse loop, two outer and one inner closed triangles, a postero-internal rounded loop about half as large as the largest triangle, and two outer and two inner re-entrant angles; anterior loop much like that of m^1, but wider externally than internally, its long axis nearly transverse to tooth-row, its length nearly equal to greatest width of tooth; closed triangles similar to last three of preceding tooth; postero-internal loop oval or elliptical, its long axis directed slightly forward. Third upper molar with anterior loop and three closed triangles essentially like those of m^2, except that closed triangles are smaller and transverse loop is nearly symmetrical and about as wide as crown at middle; behind closed triangles lies a long terminal loop subtended externally by a slight notch and internally by a deep re-entrant angle; this loop in its simplest form is indented at middle by a deep re-entrant angle which imparts to it a strongly curved crescentic outline, the anterior limb longer and more pointed than the posterior limb; outer convex surface usually marked by a slight salient angle just behind point of attachment to second outer closed triangle; in this, the most usual form, the tooth has three well developed re-entrant angles and four well developed salient angles on inner side, two well developed re-entrant angles and a notch and three well developed salient angles and a slight projection on outer side; in the most complicated form of terminal

* The presence of this loop is a normal character in the Hebridean form, *M. agrestis exsul*, some trace of it being visible in ten of the fourteen specimens examined. Among the other races it appears to be uniformly uncommon, occurring in about five per cent. of the skulls seen.

loop the inner re-entrant angle extends across to outer side, isolating a second inner closed triangle and leaving the posterior limb of crescent as a broad, rounded, backward-projecting, simple loop, the inner side of which sometimes bears an incipient re-entrant angle. First lower molar with posterior transverse loop, three inner and two outer closed triangles, and a large anterior loop indented by a deep re-entrant angle on inner side and a shallow, more posterior re-entrant angle on outer side, the latter sometimes deep enough to meet point of inner re-entrant angle subtending the terminal loop, thus isolating a third outer triangle and reducing the loop to a crescent much like that terminating m^3 in its simpler form ; rarely the extreme antero-internal border of loop shows traces of a supplemental re-entrant angle ; inner side of tooth with five well developed salient angles and a rounded anterior projection (rarely showing a tendency to divide into two), and five well developed re-entrant angles (rarely a rudimentary sixth) ; outer side of tooth with three deep, definite re-entrant angles and a shallow fourth, and four well developed salient angles and a broadly rounded anterior convexity which sometimes develops a slight basal projection ; outer re-entrant angles wider and shallower than those of inner side, their points curved forward, the contrast between the two sides much more noticeable than in the maxillary teeth ; outer triangles about equal in size to those on inner side of m^1, inner triangles decidedly larger and more transversely elongated ; posterior loop somewhat oblique, narrowly crescentic, slightly curved, its inner limb much the longer, its transverse diameter about equal to that of greatest width of crown. Second lower molar with transverse posterior loop, two inner and two outer closed triangles, two re-entrant and three salient angles on each side, the elements essentially like the corresponding portion of m_1 but slightly smaller ; occasionally the anterior (external) triangle develops on inner side a slight basal projection which may become sufficiently pronounced to add a rudimentary salient and re-entrant angle to those normally present. Third lower molar with three transverse loops, each side with three salient and two re-entrant angles, those of inner side much the deeper, the antero-external re-entrant angle often obsolete ; posterior loop larger than either of the others, more broadly crescentic in outline than terminal loops of m_1 and m_2, though not essentially different in form, the outer limb practically absent ; first and second loops somewhat irregular and variable in form, the first usully truncate externally, the second usually with an angular projection at outer side.

Remarks.—This species is recognizable among the European voles by the presence of the well developed postero-internal loop in the second upper molar. Externally it cannot always be distinguished with certainty, particularly in dry specimens. Throughout the greater part of its range, where the only other

member of the sub-genus is *Microtus arvalis*, fully adult individuals may be recognized by their larger size, more hairy ears, larger tubercles on sole, and by the browner, less buffy coloration, the dark and light elements of which are more coarsely mixed. As might be anticipated from the animal's wide range, numerous local forms have been developed. Seven of these are now known.

Microtus agrestis agrestis Linnæus.

1761. *Mus agrestis* Linnæus, Fauna Suecica, 2nd ed., p. 11 (Upsala, Sweden).
1766. [*Mus*] *gregarius* Linnæus, Syst. Nat., I, 12th ed., p. 84 (Germany and Sweden).
1792. *Mus arvalis nigricans* Kerr, Anim. Kingd., p. 239 (Renaming of *Mus agrestis*).
1820. *Lemmus arvalis* Nilsson, Skand. Fauna, I, p. 189 (not *Mus arvalis* Pallas).
1841. *Arvicola agrestis* de Sélys-Longchamps, Bull. de l'Acad. Royale des Sci. des Arts et Belles-Lettres de Bruxelles, VIII, pt. 2, p. 236.
1844. *L[emmus] insularis* Nilsson, Öfversigt af Kongl. Vetensk.-Akad. Förhandl., Stockholm, I, p. 34, March 20, 1844. (Ostgötha Skärgård, Sweden.)
1857. *Arvicola agrestis* a. Blasius, Säugethiere Deutschlands, p. 369 (part).
1884. *Microtus agrestis* Lataste, Ann. Mus. Civ. Stor. Nat. Genova, XX, p. 255, March, 1884.
1896. *Microtus agrestis* Barrett-Hamilton, Proc. Zool. Soc., London, p. 602.
1910. *Microtus agrestis* Trouessart, Faune Mamm. d'Europe, p. 175 (part).

Type locality.—Upsala, Sweden.

Geographical distribution.—Scandinavian Peninsula; eastward into Finland. Exact limits of range not known.

Diagnosis.—Size large (hind foot, 18 to 19·4 mm.; condylo-basal length of skulls in largest individuals, 27 to 28·5 mm.); skull with brain-case tending to be relatively short, the distance from condyle to back of interorbital constriction usually about equal to zygomatic breadth; first upper molar rarely with small postero-internal loop; general colour above a light bister, below greyish with faint buffy cast.

Colour.—Hairs of upper parts slate-black basally, those of underfur tipped (about 2 mm.) with a dull buff intermediate between the ochraceous-buff and cream-buff of Ridgway (the extreme tips often dark), the longer hairs iridescent black. The general effect is a clear brown, rather lighter than bister along back and becoming somewhat buffy on sides, everywhere rather conspicuously "lined" by the longer black hairs. Underparts well-defined light silvery grey faintly washed with buffy and darkened irregularly by the slaty bases of the hairs. Feet and under surface of tail concolor with belly; dorsal surface of tail dark brown. In winter the colour above is usually not so dark as in summer, and the "lining" on back is less conspicuous;

occasionally the shoulders are suffused with grey; tail more noticeably bicolor than in summer, and underparts of body more silvery.

Skull and teeth.—Skull large, that of old individuals becoming strongly angular and developing a knife-like ridge in interorbital region. Brain-case showing no tendency to lengthen out posteriorly, the distance from back of interorbital constriction to posterior surface of condyle barely equal to zygomatic breadth. Teeth with no special peculiarities; m^1 rarely* showing any trace of postero-internal loop.

Measurements.—Average and extremes of five adults from Upsala, Sweden: head and body, 121·8 (118–127); tail, 35·8 (33–38); hind foot, 18·4 (18–19). Average and extremes of five adults from Medstugan, Jemtland, Sweden: head and body, 126·8 (123–132); tail, 35·6 (31–39); hind foot, 18·6 (18–19·4). Adult male from Porsanger, Norway: hind foot, 18. For cranial measurements see Table, p. 676.

Specimens examined.—Seventy-three, from the following localities:—
NORWAY: Porsanger, 1 (U.S.N.M.); Brekkebygden, Trondhjem, 2; Mölmen, Kristiansamt, 4; Holaaker, Kristiansamt, 2; Hjerkin, Kristiansamt, 4; Sundal Fjeld, 1; Alverstrom, Bergen, 2 (U.S.N.M.); Bergen, 2 (U.S.N.M.); Graven, Bergen, 3 (U.S.N.M.); Gausdal, 3 (B.M. and U.S.N.M.); Asker, Kristiania, 1 (U.S.N.M.); Smaalenene, 1 (U.S.N.M.).
SWEDEN: Medstugan, Jemtland, 11; Upsala, 34 (B.M. and U.S.N.M.); near Stockholm, 2.

4 ♂.	Mölmen, Kristiansamt, Norway.	R. J. Cuninghame (C & P).	98. 5. 2. 6–9.
2 ♂.	Holaaker, Kristiansamt.	R. J. Cuninghame (C & P).	98. 2. 28. 6–7.
2 ♂.	Hjerkin, Kristiansamt. (*N. F. Ticehurst.*)	G. Barrett-Hamilton (C & P).	11. 1. 2. 46–47.
1.	Sundal Fjeld.	E. Lort Phillips (C & P).	94. 10. 22. 1.
1.	Gausdal.	Christiania Museum (E).	93. 3. 1. 12.
1.	Gausdal.	Miller Collection.	7. 7. 7. 4537.
3 ♂, 5 ♀.	Mandal.	R. J. Cuninghame (C & P).	8. 8. 9. 30–37.
1.	Jemtland, Sweden.	Baron E. de Sélys-Longchamps (P).	45. 7. 5. 12.
4 ♂.	Upsala. (*G. Kolthoff.*)	Lord Lilford (P).	0. 5. 15. 2–5.
♂, ♀.	Stockholm.	Prof. Sundevall (C).	45. 10. 25. 5–6.

MICROTUS AGRESTIS EXSUL Miller.

1908. *Microtus agrestis exsul* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 201, February, 1908. Type in British Museum.
1909. *Microtus agrestis insul* Lydekker, Zool. Record, XLV (1908), Mamm., p. 74 (Accidental renaming of *exsul*).
1910. *Microtus agrestis exsul* Trouessart, Faune Mamm. d'Europe, p. 176.

Type locality.—North Uist, Hebrides, Scotland.
Geographical distribution.—North and South Uist, Hebrides.

* In a little more than five per cent. of the specimens examined.

Diagnosis.—Size and cranial characters as in the large *Microtus agrestis agrestis* of Norway and Sweden ; first upper molar with small third inner loop usually present (in ten among fourteen skulls examined), almost as well developed as postero-internal loop in second tooth ; colour of underparts more brownish than in the other races.

Colour.—Upper parts and sides darker and clearer (less russet) brown than in *M. agrestis hirtus* and *M. a. neglectus*, essentially as in true *agrestis ;* underparts rather heavily washed with brownish buff, this suffusion in many specimens becoming a definite, rather light ochraceous-buff.

Skull and teeth.—The skull is not distinguishable with certainty from that of true *Microtus agrestis*, but is at once recognizable among those of the British races by its large size. Teeth with no peculiarities other than the unusual frequency with which a definite postero-internal loop is present in m^1. This occurs in no less than ten of fourteen skulls examined, while in specimens of the other races it is present only eight times among 136 skulls.

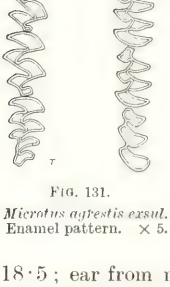

FIG. 131.
Microtus agrestis exsul.
Enamel pattern. × 5.

Measurements.—External measurements of type (adult female) : head and body, 123 ; tail, 44 ; hind foot, 19 ; ear from meatus, 12. A second female from the same locality : head and body, 111 ; tail, 39 ; hind foot, 18·5 ; ear from meatus, 12. Adult female from Loch Boisdale, South Uist : head and body, 111 ; tail, 44 ; hind foot, 18·5 ; ear from meatus, 12. For cranial measurements see Table, p. 677.

Specimens examined.—Fourteen, from the following localities in the Hebrides: North Uist, 11 (B.M. and Edinburgh); Loch Boisdale, South Uist, 3 (Edinburgh).

Remarks.—This form is of unusual interest on account of the presence as a normal character of a peculiarity of the enamel pattern occurring elsewhere in the species as a rather rare anomaly.* Its general unlikeness to the other British forms and similarity in certain respects to true *agrestis* of Scandinavia is also worthy of special note.†

♂, 3 ♀.	N. Uist, Hebrides.	J. F. Davison (C & P).	6. 3. 1. 1-4.
		(6. 3. 1. 3. *Type* of subspecies.)	
1 al.	N. Uist.	J. A. Harvie Brown (P).	79. 9. 18. 2.

* A postero-internal loop in m^1 is sometimes found in the American *Microtus pennsylvanicus*, a species with the same enamel pattern as *M. agrestis*. Such a tooth is figured in North American Fauna, No. 12, fig. 1. July 23, 1896.

† For a discussion of the general problems of distribution involved in this animal's presence in the Hebrides, see Stejneger, Smithsonian Miscell. Coll., XLVIII, pp. 458–512, May 4, 1907, and Naturen (Bergen), XXXII, pp. 193–202, 269–277, July–September, 1908.

Microtus agrestis levernedii Crespon.

1844. *A[rvicola] levernedii* Crespon, Faune Méridionale, I, p. 73 (Marshes between St. Gilles and Aigues-Mortes, Gard, France). Type in Nîmes Museum.

1857. *Arvicola agrestis* a. Blasius, Säugethiere Deutschlands, p. 369 (part).

1869. [*Arvicola agrestis*] var. *nigra* Fatio, Faune Vert. Suisse, I, p. 241 (Engstlen, Berne, Switzerland. Alt. 1750 m.). Type in Geneva Museum.

1900. [*Arvicola agrestis*] *rufa* Fatio, Revue Suisse de Zool., VIII, p. 472 (Geneva, Switzerland). Type in Geneva Museum.

1905. *Arv[icola] agrestis angustifrons* Fatio, Arch. Sci. Phys. et Nat., Genève, 4th ser., XIX, p. 191, February 15, 1905 (Meiringen, Berne, Switzerland. Alt. 650 m.). Type in Geneva Museum.

1905. *Arv[icola] agrestis latifrons* Fatio, Arch. Sci. Phys. et Nat., Genève, 4th ser., XIX, p. 194, February 15, 1905 (Geneva, Switzerland). Type in Geneva Museum.

1910. *Microtus agrestis* Trouessart, Faune Mamm. d'Europe, p. 175 (part).

Type locality.—Marshes between St. Gilles and Aigues-Mortes, Gard, France.

Geographical distribution.—Alps, Jura, and neighbouring portions of Switzerland and France; also in the extensive marshes on Mediterranean coast of France at mouth of the Rhone.

Diagnosis.—Similar to *Microtus agrestis agrestis*, but skull with brain-case tending to be longer and narrower, the distance from condyle to back of interorbital constriction usually greater than zygomatic breadth.

Measurements.—Type (adult female): hind foot (dry), 20. Adult male from the type locality: head and body, 131; tail, 46; hind foot (fresh), 20·6, (dry), 20; ear, 11·8. Immature male from the type locality: head and body, 107; tail, 39; hind foot (dry), 20; ear, 11·8. Three adult males from St. Cergues, Vaud, Switzerland: head and body, 131, 132 and 133; tail, 37, 33 and 38; hind foot (dry), 18·6, 19 and 19. Adult male from Meiringen, Berne, Switzerland: head and body, 127; tail, 40; hind foot, 18·6. For cranial measurements see Table, p. 676.

Specimens examined.—Sixty-six, from the following localities:—

France: Near St. Gilles, Gard, 6 (B.M. and Nîmes); Montauban, Haute-Savoie, 1; Cranves-Sales, Haute-Savoie, 8; Lucinges, Haute-Savoie, 2; Chamonix, Haute-Savoie, 1 (U.S.N.M.); Étupes, Doubs, 1.

Switzerland: Geneva, 9 (Mottaz and Geneva; types of *latifrons* Fatio and *rufa* Fatio among latter); St. Cergues, Vaud, 5 (U.S.N.M.); Chesières, Vaud, 3 (Mottaz); Vallée de Joux, Vaud, 3 (Mottaz); Les Plans, Vaud, 1 (U.S.N.M.); Grindelwald, Berne, 1 (U.S.N.M.); Meiringen, Berne, 20 (B.M., U.S.N.M. and Geneva; type of *angustifrons* Fatio among latter); Brünig, Berne, 1; Engstlen, Berne, 1 (Geneva; type of *niger* Fatio); Degersheim, St. Gallen, 1 (U.S.N.M.); Chur, Grisons, 1 (U.S.N.M.); Oberholsen Valley, 1.

Remarks.—Though not well differentiated from true *Microtus agrestis* the Alpine form is usually distinguishable by its relatively more elongate brain-case, a character often more evident in sub-adult individuals than in those of more advanced age. The

material representing the marsh-inhabiting animal to which the name *levernedii* was originally applied is too meagre to permit any final decision as to the identity of this form with that occurring in Switzerland. The brain-case in the type as well as in the five other specimens examined is of the elongated form characteristic of the Alpine race as compared with true *agrestis*. The hind foot, however, appears to be rather constantly larger than in the Swiss animal. Eventually it may prove that the name *levernedii* must be restricted to this semi-aquatic vole, in which event the name *niger* of Fatio would be available for the Swiss form.

4 ♂.	St. Gilles, Gard, France.	G. S. Miller (C).	8. 8. 4. 233–236.
♂.	Montauban, Haute-Savoie, 900 m. (*A. Robert.*)	O. Thomas (P).	6. 4. 2. 7.
♂, ♀.	Cranves-Sales, Haute-Savoie, 900 m.	A. Robert (C & P).	5. 4. 9. 8–9.
5 ♂, ♀.	Cranves-Sales, Haute-Savoie, 1200 m. (*A. Robert.*)	O. Thomas (P).	5. 11. 8. 24–27, 29, 32.
♀.	Lucinges, Haute-Savoie, 900 m. (*A. Robert.*)	O. Thomas (P).	6. 4. 2. 7–8.
♀.	Étupes, Doubs. (*C. Mottaz.*)	O. Thomas (P).	8. 8. 10. 115.
2.	Meiringen, Berne, Switzerland.	Tomes Collection.	7. 1. 1. 139–140.
1.	Oberholsen Valley.	Tomes Collection.	7. 1. 1. 138.

Microtus agrestis bailloni de Sélys-Longchamps.

1841. *Arv*[*icola*] *bailloni* de Sélys-Longchamps, Atti della seconda Riunione degli Scienziati Italiani, Torino, 1840, p. 225 (Northern France; Abbeville, Somme, from context).

1845. ? *A*[*rvicola*] *intermedia* Bonaparte, Atti della sesta Riunione degli Scienziati Italiani, Torino, 1844, p. 350 (cited as doubtful synonym of *bailloni*, with de Sélys-Longchamps as authority). Nomen nudum.

1857. *Arvicola agrestis* a. Blasius, Säugethiere Deutschlands, p. 369 (part).

1896. *Microtus agrestis neglectus* Barrett-Hamilton, Proc. Zool. Soc., London, p. 602 (part).

1910. *Microtus agrestis neglectus* Trouessart, Faune Mamm. d'Europe, p. 176 (part).

Type locality.—Abbeville, Somme, France.

Geographical distribution.—Western Continental Europe from the shores of the Baltic southward into central Germany and south-western France. Southern and eastern limits of range not known.

Diagnosis.—Similar to *Microtus agrestis agrestis* but smaller (hind foot, 17 to 18·6 mm.; condylobasal length of skull in largest individuals, 24·5 to 26·6 mm.); skull with brain-case tending to assume the narrower form characteristic of *M. agrestis levernedii*.

Measurements.—Adult male from Hilleröd, Zealand, Denmark: head and body, 113; tail, 35; hind foot, 18·2; ear, 13·5.

Average and extremes of seven adults from Brunswick, Germany : head and body, 116·2 (109–123) ; tail, 38·8 (36–44) ; hind foot, 17·2 (16·6–18). Young-adult male from Guines, Pas-de-Calais, France : head and body, 103 ; tail, 34 ; hind foot, 17. Young-adult male from Barbizon, Seine-et-Marne, France : head and body, 98 ; tail, 32 ; hind foot, 17·6. Adult male from Porté, Pyrénées-Orientales, France : head and body, 120 ; tail, 41 ; hind foot, 17. For cranial measurements see Table, p. 678.

Specimens examined.—Forty-five, from the following localities :—
DENMARK : Hilleröd, Zealand, 3 ; Skansen, Lolland, 1 (U.S.N.M.).
GERMANY : Brunswick, 28 (U.S.N.M.).
FRANCE : Guines, Pas-de-Calais, 1 ; Dinan, Côtes-du-Nord, 1 ; Manonville, Meurthe-et-Moselle, 1 ; Barbizon, Seine-et-Marne, 3 ; Mont Dore, Puy-de-Dôme, 1 ; Solférino, Landes, 1 ; Forêt-de-Bouconne, Gers, 1 ; Porté, Pyrénées-Orientales, 2 ; l'Hospitalet, Ariège, 1 ; Pyrenees, no exact locality, 1.

♂, 2 ♀.	Hilleröd, Zealand, Denmark.	O. Thomas (C & P).	98. 6. 7. 20–22.
♂.	Guines, Pas-de-Calais, France.	O. Thomas (C & P).	94. 6. 6. 18.
♂.	Manonville, Meurthe-et-Moselle. (*Lomont.*)	Lord Lilford (P).	1. 11. 7. 12.
♂, ♀.	Barbizon, Seine-et-Marne.	G. S. Miller (C).	8. 8. 4. 231–232.
♂.	Solférino, Landes. (*A. Robert.*)	O. Thomas (P).	6. 4. 1. 75.
♀.	Forêt de Bouconne, Gers. (*A. Robert.*)	O. Thomas (P).	6. 4. 1. 76.
♂, ♀.	Porté, Pyrénées-Orientales.	G. S. Miller (C).	8. 8. 4. 229–230.
♀.	L'Hospitalet, Ariège.	G. S. Miller (C).	8. 8. 4. 228.
♂ juv.	Mt. Dore, Puy-de-Dôme, 4500 ft.	G. S. Miller (C).	8. 8. 4. 227.

MICROTUS AGRESTIS HIRTUS Bellamy.

1839. *Arvicola hirta* Bellamy, Nat. Hist. South Devon, p. 373 (Devonshire, England).

1847. *A[rvicola] britannicus* de Sélys-Longchamps, Revue Zoologique, 1847, p. 307, October, 1847 (England).

1847. [*Arvicola*] *britannicus* de Sélys-Longchamps, Atti della ottona Riunione degli Scienziati Italiani, Genova, 1846, p. 495.

1857. *Arvicola agrestis* b. Blasius, Säugethiere Deutschlands, p. 369 (part).

1896. *Microtus agrestis neglectus* Barrett-Hamilton, Proc. Zool. Soc., London, p. 602 (part).

1910. *Microtus agrestis neglectus* Trouessart, Faune Mamm. d'Europe, p. 176 (part).

Type locality.—Yealmpton, Devonshire, England.

Geographical distribution.—England and the lowlands of southern Scotland.

Diagnosis.—Size as in *Microtus agrestis bailloni* or slightly smaller (hind foot, 17 to 18 mm. ; condylobasal length of skull in largest individuals, 24·5 to 26 mm.) ; skull with brain-case

tending to assume the short squarish form characteristic of true *agrestis;* upper parts noticeably tinged with russet, and belly heavily washed with wood-brown.

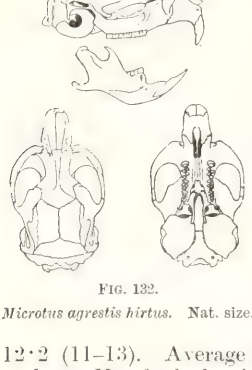

FIG. 132.
Microtus agrestis hirtus. Nat. size.

Colour.—General effect of upper parts a tawny russet very indistinctly "lined" with black, the individual hairs slate-black basally, the light portion closely approaching orange-buff, though not so bright; sides paler and with a noticeable buffy tinge; underparts light ochraceous-buff irregularly darkened by the slaty bases of the hairs; feet and under surface of tail concolor with belly; upper surface of tail dark brown.

Measurements.—Average and extremes of five adults from the New Forest, Hampshire: head and body, 113·4 (109–118); tail, 35·2 (33–39); hind foot, 17·3 (16·6–18); ear, 12·2 (11–13). Average and extremes of five adults from Graftonbury, Hereford: head and body, 113·2 (108–120); tail, 31·5 (29–33); hind foot, 16·7 (16–18). Average and extremes of four adults from Great Grimsby, Lincolnshire: head and body, 110 (108–112); tail, 29·2 (27–32); hind foot, 16·5 (16–18). For cranial measurements see Table, p. 678.

Specimens examined.—One hundred and thirty-four, from the following localities:—

SCOTLAND: Windygates, Fife, 4; Stockbriggs, Lanarkshire, 2; Blackwood, Lanark, 7; Crieff, Perthshire, 1; Drumlaurig Woods, Dumfries, 1; Kirtle Bridge, Dumfries, 4; Wyseby, Dumfries, 3; Hawick, Roxburghshire, 1.

ENGLAND: Marsham, Yorkshire, 1; Dunham Park, Bowdon, Cheshire, 1; Longendale East, Cheshire, 1; Grimsby, Lincolnshire, 19; Grainsby Hall, Lincolnshire, 5; Cheadle, Staffordshire, 1; Anglesey, Carnarvonshire, 1; St. Bride's, Pembrokeshire, 1; Sandringham, Norfolk, 1; Methwold Fen, Norfolk, 3; Lowestoft, Suffolk, 1; Rugby, Warwickshire, 1; Lilford, Northamptonshire, 3; Oundle, Northamptonshire, 3; Shelford, Cambridgeshire, 1; Cambridgeshire, no exact locality, 2; Graftonbury, Herefordshire, 17; Boxmoor, Hertfordshire, 1; Hampton, Middlesex, 2; Godalming, Surrey, 1; Earlsfield, Surrey, 7; Southerndown, near Bridgend, Glamorganshire, 1; New Forest, Hampshire, 20; Eversley, Hampshire, 1; St. Helens, Isle of Wight, 2; Alum Bay, Isle of Wight, 2; Bonchurch, Isle of Wight, 1; St. Leonards, Sussex, 1.

2 ♂, ♀.	Wyseby, Dumfriesshire, Scotland.	Miss D. Bate (c & p).	11. 1. 3. 267–269.
1.	Drumlaurig, Dumfriesshire.	Sir W. Jardine (c).	86. 7. 2. 11.
♀.	Crieff, Perthshire.	W. R. Ogilvie-Grant (c & p).	88. 5. 30. 1.
♂, ♂ juv.	Stockbriggs, Lanarkshire.	E. R. Alston (c & p).	79. 9. 25. 54–55.
♀.	Hawick, Roxburghshire.	J. E. Harting (c & p).	11. 1. 3. 289.
♀ imm. (albino)	St. Brides, Pembrokeshire, Wales.	Hon. C. Edwards (c & p).	90. 12. 5. 2.

♀ al.	Marsham, Yorkshire, England. (*J. Carter.*)	W. B. Tegetmeier (P).	93. 8. 31. 1.
2 ♂.	Bowdon, Cheshire. (*T. A. Coward.*)	G. Barrett-Hamilton (P).	11. 1. 2. 48–49.
3 ♂, ♀.	Grimsby, Lincolnshire. (*G. H. Caton Haigh.*)	G. Barrett-Hamilton (P).	11. 1. 2. 50–53.
2 ♂, 2 ♀.	Grimsby. (*G. H. Caton Haigh.*)	W. E. de Winton (P).	11. 1. 3. 246–249.
♂, ♀.	Cheadle, Staffordshire.	E. W. H. Blogg (P).	11. 1. 3. 287–288.
♂.	Anglesey.	T. A. Coward (C & P).	11. 1. 3. 270.
2 ♂, 1 ♀.	Oundle, Northamptonshire.	Lord Lilford (C & P).	11. 1. 3. 271–273.
2 ♂, 2 ♀.	Graftonbury, Herefordshire.	W. E. de Winton (C & P).	11. 1. 3. 274–277.
♂.	Shelford, Cambridgeshire.	Dr. Hans Gadow (C & P).	5. 1. 21. 1.
2 st.	Cambridgeshire.	J. Baker (C & P).	39. 9. 29. 4–5.
3 ♂, 4 ♀.	Earlsfield, Surrey.	C. H. B. Grant (C & P).	11. 1. 3. 278–284.
2 ♂.	Alum Bay, Isle of Wight.	O. Thomas (C & P).	11. 1. 3. 285–286.
1.	Bonchurch, Isle of Wight.	Rev. C. A. Bury (C & P).	44. 9. 2. 5.
19.	New Forest, Hampshire.	G. S. Miller (C).	7. 7. 7. 2906–2924.

MICROTUS AGRESTIS NEGLECTUS Jenyns.

1841. *Arvicola neglectus* Jenyns, Ann. and Mag. Nat. Hist., 1st ser., VII, p. 270, June, 1841.
1857. *Arvicola agrestis* b. Blasius, Säugethiere Deutschlands, p. 369 (part).
1896. *Microtus agrestis neglectus* Barrett-Hamilton, Proc. Zool. Soc., London, p. 602 (part).
1910. *Microtus agrestis neglectus* Trouessart, Faune Mamm. d'Europe, p. 176 (part).

Type locality.—Moors near Megarnie Castle, Perthshire, Scotland.

Geographical distribution.—Highlands of Scotland.

Diagnosis.—Like *Microtus agrestis hirtus* but size not so small (condylobasal length of largest skulls, 25·4 to 26·6 mm.), and colour of upper parts darker and more brownish.

Colour.—The general hue of the upper parts is noticeably darker and browner than in the English form, closely resembling that of the Continental *M. agrestis bailloni*. The actual colour of the light element approximates ochraceous-buff with a faint suggestion of tawny, and the general effect may perhaps be best described as prouts-brown slightly tinged with raw umber. Underparts varying from a dull silvery grey faintly tinged with buffy to a light buffy wood-brown.

Skull and teeth.—The skull averages distinctly larger than that of *M. agrestis hirtus*, though it shows no peculiarities of form. Some of the larger skulls might readily be confused with those of small individuals of *M. agrestis agrestis* or *M. agrestis exsul;* but their true identity is shown by the small auditory bullæ, which retain the small size characteristic of the British races and *M. agrestis bailloni*. The teeth show no peculiarities; m^1

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Occipital breadth.	Occipital depth (median).	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
M. agrestis agrestis.													
Norway: Porsanger	6478 Merriam		28·2	16·4	3·8	13·0	6·8	8·0	8·2	17·4	6·6	6·2	Ridges joined, high.
Gausdal	101406	♂	28·0	16·0	3·4	—	—	7·8	8·4	—	6·6	6·2	,, ,, ,,
Hjerkin, Dovre	11. 1. 2. 46	♂	28·2	16·8	3·6	13·0	7·0	7·4	8·4	18·0	7·0	6·6	,, ,, ,,
,, ,,	11. 1. 2. 47	♂	28·4	16·8	3·6	12·8	6·8	7·8	8·4	17·6	6·8	6·6	,, ,, ,,
Bergen	141697	♂	27·0	15 8	4·0	12·8	7·2	7·6	8·0	16·8	6·8	6·4	
,,	141698	♂	27·4	—	3·8	12·4	6·6	7·2	8·0	17·0	6·6	6·4	
Holaaker	98. 2. 28. 6	♂	27·0	15 4	3·6	12·4	6·6	7·2	8·2	17·2	6·6	6·2	,, scarcely visible.
,,	98. 2. 28. 7	♂	26·8	15·6	3·8	12·4	6·8	7·2	8·0	16 8	7·0	6·8	,, ,, ,,
Sweden: Jemtland	105749	♂	27·6	—	4·0	12·2	7·0	7·8	8·2	17·0	6·6	6·2	,, nearly joined.
,,	105738	♀	26·8	15·2	3·6	12±	6·6	7·4	7·8	17·2	6·8	6·4	,, joined, low.
,,	105750	♀	27·2	15·6	3·6	12·0	6·8	7·6	8·2	17·2	6·6	6·4	,, ,, ,,
,,	154571	♀	27·4	16·0	3·4	12±	7·0	8·0	8·0	17·8	6·8	6·6	,, ,, moderate.
Upsala	85039	♀	26·6	16·0	3·6	12·8	6·8	7·4	8·0	17·0	6·6	6·6	
Finland: Tammerfors	7. 7. 7. 4533	♂	26·6	15·6	3·6	12·4	6·8	7·4	7·8	17·0	6·4	6·2	
M. agrestis levernedii.													
France: near St. Gilles, Gard	Nimes*	♀	28±†	16·0	3·6	—	—	8·0	8·6	18·0	7·2	7·0	
,, ,,	8. 8. 4. 233	♂	28·2	15·4	3·4	12·0	6·8	7·6	8·6	18·0	7·0	6·6	
Switzerland: Geneva	635 Mottaz	♂	27·4	15·8	3·4	12·0	7·0	8·0	8·4	17·0	6·6	6·4	,, ,,

Switzerland: Geneva . .	1020 Mottaz	♂	26·4	15·0	3·6	11·8	6·8	7·6	8·0	16·4	6·4	6·2	Ridges nearly joined.
Vallée-de-Joux, Vaud . .	1491 ,,	♀	27·0	15·2	3·6	12·0	6·0	7·0	7·8	16·4	7·0	6·8	,, ,,
,, ,,	1515 ,,	♂	25·8	15 0	3·6	12·0	6·4	7·0	7·6	16·8	6·6	6·2	,, ,,
,, ,,	1542 ,,	♂	26·2	14·8*	3·6	12·0	6·4	7·0	7·8	16·6	6·8	6·4	,, joined, low.
,, ,,	1936 ,,	♂	28·0	16·6	3·6	12·6	7·0	8·0	8·6	17·6	6·8	6·6	,, ,, high.
,, ,,	1978 ,,	♀	26·2	14·8	3·4	11·6	6·6	7·4	8·0	16·2	6·6	6·2	,, ,, low.
,, ,,	2179 ,,	♂	27·0	15·0	3·4	12·0	6·6	7·4	8·0	16·2	6·6	6·2	,, nearly joined.
St. Cergues .	124411	♂	27·4	—	3·8	12·2	7·0	7·2	8·2	17±	6·4	6·2	,, ,,
,, .	124412	♂	27·0	15·0	3·6	—	6·6	7·4	7·6	16·6	6·4	6·2	,, ,,
,, .	124413	♂	27·8	15·6	3·8	12·4	6·8	7·4	8·2	17·2	6·8	6·4	,, ,,
,, .	124414	♀	27·0	15·0	3·4	12·0	6·6	7·4	7·6	16·4	6·8	6·2	,, ,,
Meiringen, Berne	712. 37 Geneva‡		27·4	15·6	3·4	12·0	—	7·8	8·2	—	6·8	—	,, ,,
,, ,,	85900	♂	27·0	15·4	3·4	11·8	6·8	7·4	8·0	17·2	6·8	6·4	,, ,,
,, ,,	85891	♀	26·2	15·0	3·6	—	6·0	—	7·6	17·0	6·4	6·2	,, ,,
Engstlen ,,	712. 38 Geneva§		26·0	14·8	3·4	11±	6·2	7·2	7·8	16·6	6·4	6·4	,, wide apart, low.

M. agrestis exsul.

Scotland: North Uist, Hebrides	6. 3. 1. 1	♂	—	15·4	3·4	—	—	7·4	8·2	17·4	6·8	6·6
,, ,,	6. 3. 1. 2	♀	27·0	15·4	3·2	12·0	6·4	7·2±	8·0	17·0	7·0	6·4
,, ,,	6. 3. 1. 3*	♀	28·0	15·8	3·2	12·0	6·6	8·0	8·2	18·0	7·0	7·0
,, ,,	306 Kinnear	♂	27·0	15·6	3·4	12·2	7·0	8·0	8·0	17·4	7·0	6·8
,, ,,	307 ,,	♂	26·8	15·4	3·6	12·0	6·8	7·8	7·8	17·0	6·8	6·6
South Uist ,,	300 ,,	♂	27·8	16·2	3·2	12·6	7·0	8·0	8·0	17·0	6·8	6·8
,, ,,	298 ,,	♀	27·6	16·0	3·2	12·0	6·6	8·0	8·0	17·8	7·0	7·0

* Type.
‡ Type of *angustifrons* Fatio.

† From gnathion to upper margin of foreamen magnum, 27·4 mm.
§ Type of *nigra* Fatio.

CRANIAL MEASUREMENTS OF *MICROTUS AGRESTIS*—*continued.*

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Occipital breadth.	Occipital depth (median).	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
M. agrestis bailloni.													
Denmark: Hilleröd, Zealand .	98. 6. 7. 19	♂	25·8	14·2	3·2	11·6	6·0	7·6	7·4	16·0	6·2	6·0	Old.
Germany: Brunswick . .	85270	♂	25·4±	15·8	3·6	12·2	—	7·6	7·6	16·2	6·4	6·2	Ridges joined, low.
,, . .	85275	♂	25·8	15·2	3·6	12·2	6·8	7·4	7·6	16·0	6·2	6·0	,, ,, ,,
,, . .	85652	♂	25·8	15·0	3·6	11·8	6·6	7·0	7·4	16·2	6·4	6·2	,, ,, ,,
,, . .	85654	♂	25·6	15·0	3·6	12·0	6·4	7·2	7·6	16·0	6·2	6·0	,, ,, ,,
,, . .	85658	♂	26·4	15·0	3·4	12·4	6·4	7·4	7·4	16·0	6·4	6·2	,, nearly joined.
,, . .	85659	♂	25·2	15·0	3·4	11·4	6·2	7·2	7·0	15·8	6·4	6·2	,, ,,
M. agrestis hirtus.													
Scotland: Lanarkshire . .	51 Kinnear	♀	25·4	15·0	3·2	11·4	6·6	6·8	7·2	16·0	6·2	6·0	
Fifeshire . .	133 ,,	♂	25·6	14·4	3·0	11·6	6·0	7·4	7·8	16·0	6·0	5·8	Old.
,, . .	169 ,,	♂	26±	15·2	3·2	12·0	6·2	7·4	7·8	16·2	6·2	6·2	
Dumfriesshire .	11. 1. 3. 269	♀	24·6	15·0	3·2	11·2	6·2	—	7·2	16·0	6·2	6·2	Ridges nearly joined.
England: Bowdon, Cheshire .	11. 1. 2. 48		25·0	14·0	3·0	11±	6·0	7·0	7·4	15·8	6·2	6·0	,, joined, high.
,, ,, .	11. 1. 2. 49		25·6	15 0	3·4	12·0	6·4	7·2	7·4	15·8	6·4	6·4	,, ,, ,,
Anglesey, Carnarvonshire .	11. 1. 3. 270	♂	24·4	14·0	3·2	11·4	6·0	6·8	7·0	15·2	6·2	6·0	,, ,, low.

England: Northamptonshire.	11. 1. 3. 271		25·4	15·0	3·2	11·6	6·6	7·0	7·2	15·8	6·0	5·8	
Graftonbury, Hereford . . .	11. 1. 3. 277	♀	24·6	14·0	3·2	11·0	6·0	7·0	7·2	15·4	6·2	6·0	
Earlsfield, Surrey .	11. 1. 3. 278		24·6	14·8	3·2	11·8	6·6	6·8	7·0	15·6	6·0	6·0	
,, ,, .	11. 1. 3. 279		25·6	14·6	3·2	11·4	6·4	7·2	7·4	15·8	5·8	6·0	
,, ,, .	11. 1. 3. 280		25·0	14±	3·4	11·4	6·0	6·8	7·2	15·6	6·2	6·0	
New Forest, Hampshire . . .	7. 7. 7. 2906	♀	25·4	14·6	3·2	11·2	6·0	7·0	7·2	16·0	6·4	6·2	
,, ,, .	7. 7. 7. 2918		25·0	15·0	3·2	12·2	6·8	7·2	7·2	15·6	6·2	6·0	Ridges joined, high.
,, ,, .	7. 7. 7. 2982		25±	14·8	3·4	11·4	6·4	6·6	6·8	15·8	6·2	6·0	,, ,, low.
M. agrestis neglectus.													
Scotland: Beauly, Inverness .	8. 1. 4. 2	♀	25·0	—	3·4	11·2	6·0	6·8	7·0	15·4	6·4	6·4	,, nearly joined.
,, ,, .	8. 1. 4. 3	♀?	25·4	14·4	3·2	11·8	6·2	7·0	7·2	16·0	6·6	6·2	,, joined, low.
,, ,, .	153005	♀	25·4	14·4	3·4	11·6	6·2	6·8	7·2	16·2	6·6	6·4	,, nearly joined.
Rannoch, Perthshire . . .	—	♂	26·6	—	—	—	—	—	—	—	—	—	,, ,,
,, ,, .	—	♂	26·6±	—	—	—	—	—	—	—	—	—	,, joined, low.
M. agrestis rozianus.													
Spain: Villalba, Lugo . .	94. 1. 1. 14		—	15·0	3·6	—	—	7·4	7·6	16·0	6·8	6·4	
La Coruña. . .	95. 4. 29. 3		25·2	14·8	3·8	11·4	6·6	7·6	7·4	16·0	6·4	6·0	

with postero-internal loop present in the usual small percentage of individuals.

Measurements.—Two adult males from Kinloch, Rannoch, Perthshire: head and body, 120 and 120; tail, — and 43; hind foot, 18 and 18·6; ear, 12 and 12. Adult female from the same locality: head and body, 121; tail, 46; hind foot, 18·6. Two adult females from Beauly, Inverness: tail, 37 and 38; hind foot, 18 and 18. For cranial measurements see Table, p. 679.

Specimens examined.—Thirteen, from the following localities in Scotland: Black Island, Cromarty, 1; Elgin, 1; Dunphail, Elgin, 1; Beauly, Inverness, 3; summit of Ben Nevis, Inverness, 2; Speam Bridge, Inverness, 1; Stonehaven, Kincardineshire, 1; Kinloch, Rannoch, Perthshire, 3.

♂, 2 ♀.	Beauly, Inverness-shire, Scotland.	Hon. Margaret Fraser (c & p).	8. 1. 4. 1–3.
2 al.	Ben Nevis, Inverness.	W. R. Ogilvie-Grant (c & p).	82. 10. 6. 1–2.
1 al.	Stonehaven, Kincardineshire.	E. Lort Phillips (c & p).	85. 10. 5. 1.
2 ♂, ♀.	Rannoch, Perthshire. (*F. J. Cox.*)	Hon. N. C. Rothschild (p).	8. 9. 14. 1–3.
♀.	Dunphail, Elgin.	W. R. Ogilvie-Grant (c & p).	11. 1. 3. 405.
♀.	Elgin.	W. R. Ogilvie-Grant (c & p).	11. 1. 3. 404.

Microtus agrestis rozianus Bocage.

1865. *Arvicola rozianus* Bocage, Mem. Acad. Real das Sciencias de Lisboa, N.S., III, pt. 2, p. 7 (articles separately paged).
1910. *Microtus agrestis rosianus* Trouessart, Faune Mamm. d'Europe, p. 177.

Type locality.—Geria, near Coimbra, Portugal.

Geographical distribution.—Portugal and north-western Spain. Limits of range unknown.

Diagnosis. Size and general appearance, so far as is known,* as in *Microtus agrestis baillonii*; skull with auditory bullæ noticeably flattened, and so reduced in size that the greatest diameter (from paroccipital process to tip of anterior spine) is contained $3\frac{1}{2}$ times instead of three times in condylobasal length; teeth relatively somewhat larger than in the other small forms.

Colour.—Unknown (the only specimens seen have been injured by long immersion in alcohol).

Skull.—In general form the skull agrees with that of the other small races of *Microtus agrestis*, but it is immediately recognizable by the small, slightly inflated auditory bullæ, no approach to which has been seen among the considerable number of skulls examined from other parts of Europe. The peculiarities of the bulla are best seen in side view.

* The colour of the only skin examined has been altered by the action of alcohol.

Teeth.—While in no way essentially different from those of the other small races of *Microtus agrestis* the teeth of *M. a. rozianus* appear to be relatively a little larger (see measurements, p. 679), though the difference may prove to be merely an individual peculiarity in the two skulls seen. In one of these specimens there is a minute postero-internal triangle in the first upper molar.

Measurements.—External measurements of adult female from Villalba, Lugo, Spain: head and body, 100; tail, 39; hind foot, 18·8. For cranial measurements see Table, p. 679.

Specimens examined.—Three, from the following localities in Spain: La Coruña, 1; Villalba, Lugo, 2.

2 al.	Villalba, Spain.	Dr. V. L. Seoane (C & P).	94. 1. 1. 14–15.
1 al.	Coruña.	Dr. V. L. Seoane (C & P).	95. 4. 29. 3.

MICROTUS ARVALIS Pallas.

(Synonymy under subspecies.)

Geographical distribution.—Continental Europe from the Baltic to the Pyrenees and northern Italy, and from the Atlantic coast eastward.

Diagnosis.—Size less than in *Microtus agrestis* (hind foot, 15 to 18·6 mm.; condylobasal length of skull in fully adult individuals, 23·4 to 26·6 mm.); plantar and palmar tubercles relatively smaller; second upper molar without small postero-internal loop; first lower molar with four re-entrant angles on inner side; skull slender or moderately broad (ratio of zygomatic breadth to condylobasal length ranging from 50 to 57), never conspicuously flattened and never assuming a "fossorial" aspect, the upper incisors nearly perpendicular.

External characters.—In general not essentially different from *Microtus agrestis*, but ear less hairy and with meatal lobe much less developed, barely half as high; feet as in *agrestis* except that the tubercles on both palm and sole are relatively smaller, those on fore foot occupying scarcely more than half area of palm (that at base of thumb barely more than twice as large as thumb itself), those on hind foot occupying distinctly less than half region in which they occur; in form the tubercles all tend to be more evenly rounded than in *M. agrestis*, owing to the less degree of crowding.

Skull.—Apart from its smaller size the skull differs from that of *Microtus agrestis* in the broader, shorter, more depressed brain-case, the outline of which when viewed from above is distinctly rounded both in front, behind, and at the sides, seldom if ever showing any trace of the squaring characteristic of the larger animal; postorbital process low, not distinctly angular; inter-parietal with antero-posterior diameter, exclusive of median projection, obviously more than half transverse diameter, the

exact proportion of length to breadth varying in the different races; auditory bullæ frequently though not always larger than in *M. agrestis* (proportionately to size of skull); nasals narrowing more gradually backward, not abruptly contracted at middle; mandible with coronoid process usually less noticeably curved backward, and articular process marked on outer side by a more obvious protuberance over base of incisor-root.

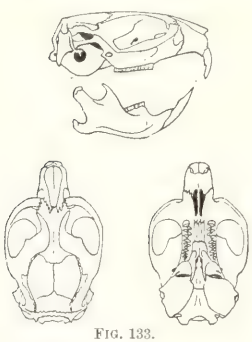

FIG. 133.
Microtus arvalis. Nat. size.

Teeth.—Incisors as in *Microtus agrestis* except that the front face of upper teeth is more nearly flat, that is, less obliquely rounded off at outer side. Molars both above and below differing from those of *M. agrestis* in a general tendency toward wider re-entrant angles and smaller closed triangles, which gives the pattern as a whole a less compact appearance. In details of enamel folding the only important difference between the two animals is the complete absence in *M. arvalis* of a postero-internal loop to m^2. The third upper molar has exactly the same elements as that of *M. agrestis*, and is subject to similar variations in form. First lower molar with re-entrant angle on inner side of anterior loop usually less developed than in *M. agrestis*, that on outer side somewhat deeper, so that the two are approximately equal; this causes the loop to appear to project forward, or to turn outward instead of inward.

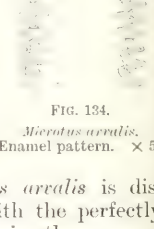

FIG. 134.
Microtus arvalis.
Enamel pattern. × 5.

Remarks.—Among European voles *Microtus arvalis* is distinguished by its enamel pattern combined with the perfectly normal skull and small or medium size. As in the case of *M. agrestis*, dry specimens, particularly those that are faded and distorted, cannot always be positively determined. Though always conforming to the tetramerodont type common to the majority of species of true *Microtus* occurring in both the Old World and America, the enamel pattern shows a somewhat unusual tendency toward individual variation in exact details of form.* These variations appear to be in no way characteristic of local races; and the five subspecies here recognized are based on other characters.

* The variations in the enamel pattern have been studied and figured in great detail by Rörig and Börner, Arbeiten aus der Kaiserlichen Biologischen Anstalt für Land- und Forstwirtschaft, v, Heft II, pp. 37–89, pls. iv–vi, 1905.

MICROTUS ARVALIS ARVALIS Pallas.

1778. *Mus arvalis* Pallas, Nov. Sp. Quadr. Glir. Ord., p. 78 (Germany).
1801. *M[us] arv[alis] albus* Bechstein, Gemeinn. Naturgesch. Deutschlands, I, 2nd ed., p. 998 (Thüringen, Germany).
1803. *Lemmus fulvus* Geoffroy, Catal. Mammif. du Mus. Nat. d'Hist. Nat., Paris, p. 187 (France).
1822. *Arvicola vulgaris* Desmarest, Mammalogie, pt. II, p. 282.
1840. *Arvicola arvensis* Schinz, Europ. Fauna, I, p. 60 (Substitute for *arvalis*).
1841. [*Arvicola*] *arvalis* de Sélys-Longchamps, Bull. de l'Acad. Royale des Sci. des Arts et Belles-Lettres de Bruxelles, VIII, pt. 2, p. 235 (*arvalis* for the first time clearly distinguished from *agrestis*).
1845. ? [*Arvicola arvalis*] var. *ater* de Sélys-Longchamps, Atti della sesta Riunione degli Scienziati Italiani, Torino, 1844, p. 321 (Nomen nudum).
1847. ?? *Arvicola cunicularius* Ray, Rev. Zool., p. 312, October, 1847 (Riceys, near Troyes, Aube, France).
1853. *Arvicola campestris* Blasius, Gelehrte Anzeigen, München, XXXVII, p. 106, July 29, 1853 (Brunswick, Germany). For identification with *arvalis* see Rörig and Börner, Arbeiten aus der Kaiserlichen Biologischen Anstalt für Land- und Forstwirtschaft, V, Heft II, pp. 74–75, 1905.
1857. *Arvicola campestris* Blasius, Säugethiere Deutschlands, p. 375.
1857. *Arvicola arvalis* Blasius, Säugethiere Deutschlands, p. 379.
1884. *Microtus arvalis* Lataste, Ann. Mus. Civ. Stor. Nat., Genova, XX, p. 259, March, 1884.
1905. *Arvicola arvalis, galliardi* Fatio, Arch. Sci. Phys. et Nat., Genève, 4th ser., XIX, p. 197, February 15, 1905 (Bulle, Fribourg, Switzerland). Type in Geneva Museum.
1905. [*Arvicola arvalis*] forma *variabilis* Rörig and Börner, Arbeiten aus der Kaiserlichen Biologischen Anstalt für Land- und Forstwirtschaft, V, Heft II, p. 73 (Wahlstatt, near Liegnitz, Silesia, Germany).
1905. [*Arvicola arvalis*] forma *contigua* Rörig and Börner, Arbeiten aus der Kaiserlichen Biologischen Anstalt für Land- und Forstwirtschaft, V, Heft II, p. 76 (Rothenburg, Silesia, Germany).
1905. [*Arvicola arvalis*] forma *assimilis* Rörig and Börner, Arbeiten aus der Kaiserlichen Biologischen Anstalt für Land- und Forstwirtschaft, V, Heft II, p. 77 (Darmstadt, Hessen, Germany).
1905. [*Arvicola arvalis*] forma *depressa* Rörig and Börner, Arbeiten aus der Kaiserlichen Biologischen Anstalt für Land- und Forstwirtschaft, V, Heft II, p. 88 (Bautzen, Saxony, Germany).
1905. [*Arvicola arvalis*] forma *simplex* Rörig and Börner, Arbeiten aus der Kaiserlichen Biologischen Anstalt für Land- und Forstwirtschaft, V, Heft II, pl. V (Gransee, Brandenburg, Germany).
1905. [*Arvicola arvalis*] forma *principalis* Rörig and Börner, Arbeiten aus der Kaiserlichen Biologischen Anstalt für Land- und Forstwirtschaft, V, Heft II, pl. V (Burghessler, near Kösen, Thüringen, Germany).
1910. *Microtus arvalis* Trouessart, Faune Mamm. d'Europe, p. 173 (part).
1910. *Microtus agrestis campestris* Trouessart, Faune Mamm. d'Europe, p. 176.

Type locality.—Germany. (Under the name *arvalis* Pallas included the small voles of the *arvalis* and *agrestis* type occurring in the region extending from England into western Siberia.

Germany is one of the localities mentioned in the text (p. 78), and to a form occurring in Germany the name *arvalis* was applied by de Sélys-Longchamps, the first author to distinguish between this species and *agrestis*.)

Diagnosis.—Size small (hind foot, 15 to 17 mm.; condylobasal length of fully adult skulls, 23 to 25 mm.); colour a nearly uniform, distinctly yellowish brown, the underparts usually suffused with buffy; interparietal ligulate in outline, its antero-posterior diameter (exclusive of median spine) not conspicuously more than half transverse diameter.

Colour.—Upper parts a nearly uniform yellowish brown or brownish buff, the sides more yellowish than back; light tips to hairs of underfur usually dull buff, rarely, except in abraded pelage, approaching cream-buff; black tips to longer hairs not sufficiently contrasted to produce any noticeable effect of "lining" or grizzling. Underparts varying from silvery grey to dull buff, always clouded to a varying degree by the slate-grey under-colour. Feet dull buffy white. Tail bicolor though not conspicuously so, brownish or blackish above, buffy or whitish below.

Skull and teeth.—The skull of typical *Microtus arvalis* may best be described as lacking any special peculiarities. It is moderately long and narrow, the brain-case is not particularly deepened, and the dorsal profile is without marked convexity; interparietal tending to be somewhat ligulate in outline, its antero-posterior diameter in most instances not conspicuously more than half transverse diameter; nasals sloping forward at an angle of about 23°; interorbital ridges uniting to form an evident crest in fully adult individuals; auditory bullæ rather large, smoothly inflated. Teeth small, the enamel pattern normal, though showing all the phases of individual variation known in the European forms.

Measurements.—Average and extremes of ten adults from Brunswick, Germany: head and body, 104 (100–111); tail, 40 (35–45); hind foot, 15·4 (15–16). Two adult males from near base of the Dôle, Vaud, Switzerland: head and body, 110 and 116; tail, — and 36; hind foot, 15·6 and 16. Adult male and female from Fiorentina, Bologna, Italy: head and body, 111 and 104; tail, 40 and 32; hind foot, 15·8 and 15·6; ear, 12 and 12. For cranial measurements see Table, p. 688.

Specimens examined.—One hundred and seventy-nine, from the following localities:—

BELGIUM: Liége, 1; Waremme, Liége, 6 (U.S.N.M.); Maredsous, Namur, 3.

FRANCE: Étupes, Doubs, 21 (B.M., U.S.N.M. and Mottaz); Lucinges, Haute-Savoie, 2; Montauban, Haute-Savoie, 2; Cranves-Sales, Haute-Savoie, 5; Scientriers, Haute-Savoie, 2 (Mottaz); Forêt de Bouconne, Gers, 1.

GERMANY: Brunswick, 16 (U.S.N.M.); Kalbe, Saxony, 1; Schwarzburg, Thüringen, 2; Ummerstadt, Thüringen, 3; Rudolstadt, Thüringen, 1; Kalbe, Saxony, 1; Magdeburg, Saxony, 11; Moritzburg, Saxony, 5 (U.S.N.M.); Dresden, Saxony, 3 (U.S.N.M.); Tharandt, Saxony, 1; Niesky,

Silesia, 5; Wolfshau, Riesengebirge, Silesia, 2 (U.S.N.M.); Marxheim, near Monheim, Bavaria, 2; Strassburg, 3; Mark Brandenburg, 2.

AUSTRIA-HUNGARY: Prag, Bohemia, 3; Csallóköz-Somorja, Pressburg, Hungary, 7.

SWITZERLAND: Geneva, 16 (B.M., U.S.N.M. and Mottaz); near base of the Dôle, Vaud, 17 (U.S.N.M. and Mottaz); Vallée de Joux, Vaud, 1 (Mottaz); Chesières, Vaud, 6 (Mottaz); Lausanne, Vaud, 4 (U.S.N.M.); Neuchatel, 1 (U.S.N.M.); Bulle, Fribourg, 1 (Geneva; type of *galliardi* Fatio); Meiringen, Berne, 1 (U.S.N.M.); Vitznau, Lucerne, 1; Züberwangen, St. Gallen, 11 (U.S.N.M. and Mottaz); Mels, St. Gallen, 3 (U.S.N.M.); Val Tours, Grisons, 1 (U.S.N.M.).

ITALY: Milan, 1; Fiorentina, Bologna, 3; Ferrara, 1.

1.	Liége, Belgium.	Baron E. de Sélys-Longchamps (F).	37. 1. 3. 173.
2 ♂, ♀.	Maredsous, Namur.	Rev. G. Fournier (P).	3. 3. 30. 3–5.
5 ♂, ♀.	Étupes, Doubs, France. (*C. Mottaz.*)	O. Thomas (P).	8. 8. 10. 106–111.
2 ♂.	Cranves - Sales, Haute-Savoie.	A. Robert (C & P).	5. 4. 9. 10–11.
♂, 2 ♀.	Cranves - Sales, Haute-Savoie. (*A. Robert.*)	O. Thomas (P).	5. 11. 18. 28, 30–31.
♀.	Forêt de Bouconne, Gers. (*A. Robert.*)	O. Thomas (P).	6. 4. 1. 77.
2 ♂.	Schwarzburg, Thüringen, Germany. (*Schuchardt.*)	Lord Lilford (P).	95. 4. 18. 15–16.
2 ♀.	Ummerstadt, Thüringen. (*Schuchardt.*)	Lord Lilford (P).	1. 11. 7- 7–8.
♂.	Rudolstadt, Thüringen. (*Schuchardt.*)	Lord Lilford (P).	1. 7. 7. 10.
♂.	Kalbe, Saxony.	Lord Lilford (P).	1. 7. 7. 9.
♀, 2 juv. al.	Magdeburg, Saxony.	Dr. W. Wolterstorff (C & P).	92. 12. 1. 21–23.
2 ♂, 3 ♀.	Magdeburg. (*Dr. Wolterstorff.*)	Lord Lilford (P).	1. 11. 7. 1–5.
1 al.	Tharandt, Saxony. (*Nitsche.*)	Berlin Museum (E).	93. 1. 1. 20.
♂, 2 ♀.	Niesky, Silesia.	Dr. E. Hamilton (P).	97. 12. 4. 28–30.
2.	Niesky, Silesia. (*W. Baer.*)	Lord Lilford (P).	99. 1. 9. 20–21.
♂.	Marxheim, Bavaria. (*Dr. Wolterstorff.*)	Lord Lilford (P).	1. 11. 7. 6.
3 ♂.	Strassburg, Alsace. (*C. Mottaz.*)	O. Thomas (P).	8. 8. 10. 112–114.
2 al.	Colpin, Mark Brandenburg.	Dr. H. Gadow (C & P).	82. 7. 31. 3–4.
7.	Csallóköz-Somorja, Pressburg, Austria-Hungary.	Budapest Museum (E).	94. 3. 1. 66–72.
♂, 2 ♀ al.	Prag, Bohemia.	V. Frič (P).	90. 1. 30. 2–4.
♂.	Geneva, Switzerland.	E. R. Alston (P).	79. 9. 25. 52.
♂.	Vitznau, Lucerne.	O. Thomas (C & P).	5. 8. 3. 21.
♂, 2 ♀.	Fiorentina, Bologna, Italy.	Genoa Museum (E).	8. 7. 18. 8. 8. 8. 2. 3–4.
1.	Milan.	Baron E. de Sélys-Longchamps (F).	45. 7. 5. 11.

Microtus arvalis meridianus Miller.

1908. *Microtus arvalis meridianus* Miller, Ann. and Mag. Nat. Hist. 8th ser., I, p. 197, February, 1908. Type in British Museum.
1910. *Microtus arvalis meridianus* Trouessart, Faune Mamm. d'Europe, p. 174.

Type locality.—Near Biarritz, Basses-Pyrénées, France.

Geographical distribution.—South-western France, in and near the Pyrenees.

Diagnosis.—Like *Microtus arvalis arvalis* but larger (hind foot, 15·8 to 16·6; condylobasal length of fully adult skulls, about 25·5 mm.), and slightly more yellowish.

Colour.—The colour so nearly resembles that of the typical race as to require no detailed description. In general there appears to be a tendency toward more conspicuous suffusion of sides and underparts with buff.

Skull and teeth.—Apart from their greater size the skull and teeth resemble those of *M. arvalis arvalis*. In some specimens, however, the brain-case is unusually short, its outline almost circular.

Measurements.—External measurements of type (adult female): head and body, 115; tail, 32; hind foot, 16·6; ear, 12. Average and extremes of four adult individuals from the type locality: head and body, 106·2 (102–115); tail, 31·7 (30–34); hind foot, 16·1 (15·8–16·6); ear, 11·2 (10–12). For cranial measurements see Table, p. 689.

Specimens examined.—Eleven, from the following localities in south-western France: Porté, Pyrénées-Orientales, 1; Pic du Midi, Hautes-Pyrénées, 1 skull (Lataste); Biarritz, Basses-Pyrénées, 8; Pyrenees, no exact locality, 1.

♀.	Porté, Pyrénées-Orientales, France. (*A. Robert.*)	O. Thomas (P).	8. 9. 1. 70.
2 ♂, 4 ♀.	Biarritz, Basses-Pyrénées.	J. F. Davison (C & P). (6. 6. 4. 26. *Type* of subspecies.)	6. 6. 4. 23–28.
1.	Pyrenees.	Baron E. de Sélys-Longchamps (P).	45. 7. 5. 6.
1.	——	Tomes Collection.	7. 1. 1. 137.

Microtus arvalis duplicatus Rörig and Börner.

1905. [*Arvicola arvalis*] forma *duplicata* Rörig and Börner, Arbeiten aus der Kaiserlichen Biologischen Anstalt für Land- und Forstwirtschaft, V, Heft II, pl. V.

Type locality.—Rossitten, Ostpreussen, Germany.

Geographical distribution.—Shores of the Baltic in north-eastern Germany. Limits of range not known.

Diagnosis.—Like *Microtus arvalis arvalis* but attaining a larger size (hind foot, 17 to 18·6 mm.; condylobasal length of skull in fully adult individuals about 25 to 25·5 mm.); colour

paler, less buffy and less uniform ; skull larger and heavier, the brain-case deeper than in the typical form.

Colour.—Upper parts paler than in unfaded specimens of true *arvalis*, the tips of hairs of underfur a dull cream-buff against which the black tips of long hairs are rather noticeably contrasted, producing an evident effect of grizzling seldom approached in the typical form. Underparts a light grey (about Ridgway's No. 10), dulled by the appearance at surface of slaty under-colour, and occasionally (much less often than in true *arvalis*) washed with light buff. Feet hair-brown occasionally with a buffy tinge. Tail obscurely bicolor, dark brownish above, dull white below.

Skull and teeth.—The skull differs from that of *M. arvalis arvalis* in its general greater size and more robust form, the latter peculiarity often more noticeable in the rostrum than elsewhere ; brain-case essentially like that of true *arvalis* when viewed from above, the lateral ridges well developed in fully adult individuals, its depth decidedly greater than in the typical form ; auditory bullæ large and well inflated. Teeth showing no special peculiarities.

Measurements.—Average and extremes of ten adults from the neighbourhood of Tenkitten, Ostpreussen, Germany : head and body, 111·3 (105–120) ; tail, 35·5 (31–41) ; hind foot, 17·5 (17–18·6). For cranial measurements see Table, p. 689.

Specimens examined.—Sixty, from the following localities on or near the Baltic coast of East Prussia : near Königsberg, 1 (U.S.N.M.) ; Tenkitten, 40 (U.S.N.M.) ; Frische Haff, 2 (U.S.N.M.) ; Sanglienen, 4 (U.S.N.M.) ; Legehnen, 4 (U.S.N.M.) ; Lochstedt, 4 (U.S.N.M.) ; Baltic coast, 5 (U.S.N.M.).

Remarks.—This race is readily distinguishable from the other European forms of *Microtus arvalis* by its large size, grizzled greyish colour, and robust, strongly angled skull. So far as at present known it is confined to the coast region of extreme eastern Germany.

Microtus arvalis levis Miller.

1908. *Microtus levis* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 197, February, 1908. Type in British Museum.

1910. *Microtus levis* Trouessart, Faune Mamm. d'Europe, p. 182.

Type locality.—Gageni, Prahova, Roumania (at foot of Carpathians, north-west of Bucharest).

Geographical distribution.—Roumania, southern Hungary and north-eastern Italy ; limits of range not known.

Diagnosis.—Size and external appearance essentially as in *M. arvalis duplicatus ;* skull narrow and rounded, the interorbital region not developing a distinct ridge until late in life ; brain-case long and narrow, its length measured from interorbital constriction to condyle greater than zygomatic breadth.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Occipital breadth.	Occipital depth.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
M. arvalis arvalis.													
Belgium: Maredsous	3. 3. 30. 4	♂	23·8	13·0	3·0	10·4	5·8	6·8	7·0	14·4	5·8	5·8	Old: ridges joined.
,,	3. 3. 30. 3	♂	23·0	13·2	3·0	10·4	6·0	6·4	7·0	15·0	5·6	5·4	Ridges nearly joined.
,,	3. 3. 30. 5	♀	23·4	13·0	3·0	10·4	5·6	7·0	6·8	15 0	5·8	5·6	,, ,, ,,
Germany: Brunswick	85284	♂	24·0	13·4	3·0	10·4	6·2	7·0	7·0	—	5·4	—	,, joined, low.
,,	85670	♂	24·2	13·8	3·2	11·0	6·2	6·4	6·8	14·6	5·8	5·6	,, ,, ,,
,,	85655	♀	23·2	13·4	3·0	10·4	5·8	6·6	6·8	14·6	5·8	5·6	,, nearly joined.
,,	85668	♀	23·8	13·2	3·0	10·2	6·0	6·6	7·0	15·0	5·6	5·4	,, joined, low.
,,	85672	♀	23·0	12·8	3·0	10·2	5·8	6·2	6·8	15·0	5·6	5·6	,, nearly joined.
Magdeburg, Saxony	92. 12. 1. 13	♂	24·0	13·8	3·4	11·0	6·0	7·0	7·2	15·0	5·8	5·6	
,, ,,	105768	♂	23·2	13·8	3·0	11·0	5·6	6·8	6·6	14·6	5·6	5·4	,, joined, high.
,, ,,	105769	♂	23·4	13·4	3·0	10·6	5·6	6·0	7·0	14·8	5·6	5·6	,, ,, low.
Dresden ,,	120964	♂	24·2	13·8	3·0	10·8	5·8	6·8	7·0	15·0	5·6	5·4	,, nearly joined.
,, ,,	120965	♀	24·0	13·8	3·2	10·8	6·0	6·6	7·0	15·0	5·8	5·6	,, ,, ,,
,, ,,	120966	♀	24·0	14·0	3·2	10·6	6·0	6·2	7·0	14·8	5·6	5·6	,, ,, ,,
Tharandt ,,	93. 1. 1. 20		24·0	13·4	3·2	11·0	6·0	7·0	7·4	15·4	6·0	6·0	,, ,, ,,
Austria-Hungary: Prag, Bohemia	90. 1. 30. 2	♂	23·8	14·2	3·2	11·0	5·8	7·0	7·0	14·6	5·4	5·4	,, ,, ,,
Switzerland: Geneva	637 Mottaz	♂	24·0	13·8	3·4	11·0	6·0	7·0	7·0	15·0	6·0	6·0	Fully adult.
,,	1039 ,,		24·0	14·0	3·2	11·0	6·0	6·4	7·0	15·0	6·0	6·0	,, ,,
near base of Dôle, Vaud	124416	♂	25·0	14·2	3·0	10·8	6·2	6·2	7·2	15·0	5·8	6·8	Ridges joined, low.
,, ,,	546 Mottaz	♀	24·8	13·8	3·4	10·8	5·8	6·8	7·4	15·2	5·8	5·8	Old.
Chesières	2206 ,,	♀	25·6	14±	3·2	11·2	6·0	6·8	7·4	16·2	6·0	6·0	,,

Switzerland: Vitznau, Lucerne	5. 8. 3. 21	♂	24·2	13·8	3·2	10·6	6·0	6·8	7·0	15·0	5·8	5·4	Ridges nearly joined.
Bulle, Fribourg	712, 42 / Geneva*	♀	—	14·8±	3·4	—	—	6·8	7·2	15·8	5·8	5·8	
Mels, St. Gallen	153013	♀	24·2	14·0	3·2	11·2	6·2	7·0	7·4	15·6	5·6	5·6	,, ,, ,,
,, ,,	153014	♀	23·8	—	3·2	10·8	6·0	7·0	7·0	15·0	5·6	5·4	,, joined, low.
Italy: Ferrara	789 Florence	♀	24·6	15·0	3·6	11·4	5·8	—	7·4	15·6	6·0	6·0	,, ,,
Fiorentina, Bologna	8. 8. 2. 3	♂	25·0	13·6	3·4	11·6	6·2	—	7·4	15·4	5·6	5·6	,, nearly joined.
,, ,,	8. 7. 18. 8	♀	23·6	13·6	3·4	11·4	6·0	6·6	7·0	14·6	5·8	5·6	,, ,, ,,
M. arvalis meridianus.													
France: Biarritz, Basses-Pyrénées	6. 6. 4. 26†	♀	25·4	15·0	3·0	11·0	6·0	7·2	8·0	16·2	6·4	6·4	
M. arvalis duplicatus.													
Germany: near Königsberg	112198	♂	25·2	14·2	3·6	11·4	6·8	7·4	7·6	16·2	6·0	5·8	,, 1 mm. apart.
,,	112213	♂	24·8	14·4	3·2	11·4	6·8	7·4	7·4	15·8	5·8	5·8	,, joined, low.
,,	112229	♂	25·4	14±	3·2	11·2	6·4	7·6	7·6	15·8	6·0	5·8	,, ,, ,,
M. arvalis levis.													
Roumania: Gageni	4. 4. 6. 55†	♂	26·6	14·4	3·4	12·2	6·6	7·8	8·0	16·6	6·4	6·2	
,,	4. 4. 6. 57	♂	26·6	14·8	3·2	11·6	6·6	7·6	7·6	16·4	6·4	6·4	
Bucharest	Mo. 137 / Mottaz	♂	26·6	14·4	3·0	11·8	6·4	7·8	8·0	16·0	6·0	5·8	Old.
Bulgaria: Rustschuk	Andersen	♂	27·6	15±	3·6	12·8	7·2	8·0	8·2	16·6	6·2	5·8	Ridges joined, low.
Austria-Hungary: Eszek	7. 7. 7. 3034		25·8	14·0	3·2	11·2	6·2	7·0	8·0	16·0	6·0	6·0	,, ,, ,,
,,	—		26·4	14·6	3·6	11·0	6·6	7·4	8·0	15·8	6·4	6·2	,, nearly joined.
Italy: Caorle	—	♀	26·0	14·6	3·4	11·6	6·0	8·0	8·2	16·6	5·8	5·8	,, joined, low.

* Type of *galliardi* Fatio.

† Type.

Colour.—The colour is less yellowish than in *M. arvalis arvalis*, the light element a pale cream-buff, and the black tips to the hairs slightly more conspicuous, the grizzle of upper parts thus tending to be more evident, particularly along middle of back. Feet dull whitish. Tail rather distinctly bicolor, dark brown above, buffy white below. Underparts in most specimens rather strongly suffused with pale cream-buff.

Skull and teeth.—The skull differs from that of the other European races of *Microtus arvalis* in its more elongate form, less widely spreading zygomata, and in a peculiar general smoothness and lack of angularity. Brain-case elongated, the least distance from interorbital constriction to back of condyle decidedly greater than zygomatic breadth, while in the related forms it is less than zygomatic breadth or at most barely equal. Depth of brain-case rather greater than in true *arvalis*, in this respect resembling *duplicatus*. General surface of skull noticeably smoother and less angular than in the related forms, the interorbital region and sides of brain-case rarely developing evident ridges. Auditory bullæ usually larger and more inflated than in true *arvalis*, but this character not entirely constant. Teeth with no special peculiarities.

Measurements.—External measurements of type (adult male): head and body, 110; tail, 38; hind foot, 17·2; ear from meatus, 11. Average and extremes of ten adults from the type locality: head and body, 102·8 (101–110); tail, 35·5 (31–38); hind foot, 16·6 (16·2–17·4); ear from meatus, 10·4 (10–11·5). For cranial measurements see Table, p. 689.

Specimens examined.—Thirty-two, from the following localities:—
Austria-Hungary: Cepin, near Eszek, Hungary, 8.
Roumania: Gageni, Prahova, 17; Bustenari, Prahova, 1; near Bucharest, 3 (Mottaz); Dobrudscha, 1.
Bulgaria: Rustschuk, 1 (Andersen).
Italy: Caorle, Venice, 1.

2 & 6 al.	Cepin, Eszek, Hungary.	Budapest Museum (e). 94. 7. 23. 13–20.
5 ♂, 6 ♀.	Gageni, Prahova, Roumania. (*W. Dodson.*)	Lord Lilford (p). 4. 4. 6. 53–63.
♂.	Bustenari, Prahova. (*W. Dodson.*)	(4. 4. 6. 55. *Type* of subspecies.) Lord Lilford (p). 4. 4. 6. 64.
1.	Dobrudscha, Roumania.	Purchased (Prulière). 86. 4. 2. 6.

MICROTUS INCERTUS de Sélys-Longchamps.

1841. *Arvicola incertus* de Sélys-Longchamps, Atti della Seconda Riunione degli Scienziati Italiani, Torino, 1840, p. 225 (near summit of St. Gothard, Switzerland).

1869. [*Arvicola arvalis*] var. *fulva* Fatio, Faune Vert. Suisse, I, p. 236 (near summit of Furka, Switzerland). Type in Geneva Museum.

1905. [*Arvicola arvalis*] var. *flava* Fatio, Arch. Sci. Phys. et Nat. Genève, 4th ser., XIX, p. 195, February 15, 1905 (Renaming of *fulva*).

1905. [*Microtus incertus*] Major, Ann. and Mag. Nat. Hist., 7th ser., XV, p. 511, May, 1905.

1907. *Microtus arvalis incertus* Mottaz, Mém. Soc. Zool. de France, xx, p. 32, September, 1907.
1910. *Pitymys incertus* Trouessart, Faune Mamm. d'Europe, p. 188.

Type locality.—Near summit of St. Gothard Pass, Uri, Switzerland.

Geographical distribution.—Mountains of Switzerland and Tirol, from the central Alps eastward. Details of distribution very imperfectly known.

Diagnosis.—Like *Microtus arvalis*, but skull tending to assume a distinctly fossorial aspect, the occipital region depressed (ratio of occipital depth to occipital width about 50·5 instead of 58), the rostrum elongated (diastema usually about 8 mm. in adults instead of about 7·5 mm.), the upper incisors projecting forward; auditory bullæ small and flattened.

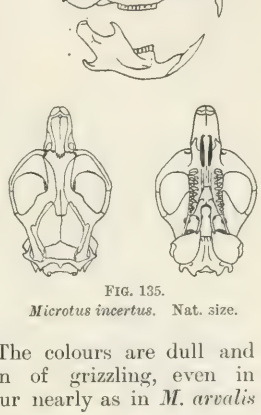

FIG. 135.
Microtus incertus. Nat. size.

External characters.—So far as can be determined from skins, the external characters are in all essentials as in *Microtus arvalis*, though from the peculiarities of the skull it seems probable that the head is more flattened and the incisors more protruding; fur tending to be longer and less dense.

Colour.—In a series of skins the colour is, on the average, less buffy above than in *Microtus arvalis arvalis*, and the underparts are more frequently a clear, slate-tinged grey. The colours are dull and blended, with very slight indication of grizzling, even in individuals with elements of the colour nearly as in *M. arvalis duplicatus*.

Measurements.—Adult male and female from Andermatt, Uri, Switzerland: head and body, 114 and 108; tail, 41 and 37; hind foot, 16 and 15·5. Adult male from Furka Pass, Switzerland: head and body, 113; tail, 31; hind foot, 15·4. Average and extremes of eight adults from Vulpera-Tarasp, Grisons, Switzerland: head and body, 111 (104–119); tail, 36·5 (30–41); hind foot, 16·4 (15·6–17); ear from meatus, 11·7 (11–13). For cranial measurements see Table, p. 692.

Specimens examined.—Sixty-six, from the following localities:—
SWITZERLAND: Furka Pass, 31 (B.M., U.S.N.M., Geneva and Mottaz); St. Gothard Pass, 2 (B.M. and U.S.N.M.); Andermatt, Uri, 7 (U.S.N.M.); Vulpera-Tarasp, Grisons, 16 (Rothschild); Campfer, Grisons, 7 (Rothschild); Engadine, 1.
AUSTRIA-HUNGARY: Meran, Tirol, 1; Paneveggio, Tirol, 1.

Remarks.—*Microtus incertus* is readily distinguishable from *M. arvalis* by its flattened brain-case, small auditory bullæ and

CRANIAL MEASUREMENTS OF *MICROTUS INCERTUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Occipital breadth.	Occipital depth.	Palatal depth.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
Switzerland: St. Gothard, Uri	46. 8. 3. 35		—	14·2	3·6	—	—	6·8	7·0	7·4	15·4	6·0	5·8	
Andermatt ,,	85681	♂	24·8	13·8	3·4	10·8	5·8	6·6	7·2	7·8	15·2	5·6	5·6	Ridges nearly joined.
,, ,,	85685	♂	24·4	15·0	3·6	11·2	5·6	7·0	7·4	7·8	15·8	6·0	6·0	,, ,,
Furka Pass ,,	153016	♂	24·0	13·8	3·6	10·8	5·4	7·0	6·4	7·2	15·2	5·8	5·8	,, 1·5 mm. apart.
,, ,, ,,	712, 40 Geneva*		25·0	14·8	3·8	11·4	6·4	—	7·0	8·0	15·8	6·2	6·0	
,, ,, ,,	1705 Mottaz	♂	25·0	15·0	3·6	11·0	6·0	—	7·2	8·0	16·0	5·4	6·0	
,, ,, ,,	1715 ,,	♀	24·6	14·0	3·6	10·8	5·6	—	7·0	8·0	16·0	5·8	6·0	
,, ,, ,,	1723 ,,	♀	25·0	13·8	3·2	10·6	5·6	6·4	6·6	7·8	15·6	6·2	6·4	,, nearly joined.
Vulpera - Tarasp, Grisons . .	Rothschild	♂	26·0	15±	3·2	12·0	6·0	8·2	7·2	8·0	16·0	5·8	5·4	,, ,,
,, ,,	,,	♂	26·4	15·4±	3·4	12·0	6·0	8·2	7·4	8·2	16·2	6·0	5·8	,, joined.
,, ,,	,,	♂	25·2	14·4	3·6	11·2	6·2	7·4	7·0	7·8	15·4	5·8	5·6	,, 1 mm. apart.
,, ,,	,,	♀	25·0	14·8	3·2	11·4	5·8	7·2	6·8	7·4	15·6	5·6	5·4	,, ,,
,, ,,	,,	♀	25±	14·8	3·4	11·2	—	7·2	6·6	7·4	16·0	5·8	5·6	,, nearly joined.
,, ,,	,,	♀	26·2	15·4	3·2	11·6	6·0	8·2	7·6	8·0	16·8	6·0	5·8	,, joined.
,, ,,	,,	♀	25·4	15·0	3·2	11·4	—	8·0	7·4	8·0	15·8	6·0	5·8	,, ,,
,, ,,	,,	♀	26±	15·4	3·4	11·4	—	7·8	7·2	8·0	16·6	6·0	6·0	,, ,,

* Type of *fulva* Fatio.

protruding upper incisors. In immature specimens the skull is strikingly like that of *Pitymys subterraneus*, but when fully adult the interorbital region becomes narrow and ridged, so that the resemblance to *Pitymys* is lost.

♂, ♀.	Furka Pass, Switzerland.	Lord Lilford (P).	1. 11. 7. 13-14.
2.	St. Gothard Pass.	Purchased.	46. 6. 15. 44, 114.
♂.	Engadine (*Fatio*).	E. R. Alston (P).	79. 9. 25. 51.
♂ al.	Meran, Tirol, Austria-Hungary.	Dr. V. Frič (P).	90. 1. 30. 1.
♀ al.	Paneveggio, Tirol.	Marquis G. Doria (P).	90. 3. 5. 15.

MICROTUS ASTURIANUS Miller.

1908. *Microtus asturianus* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 198, February, 1908.
1910. *Microtus asturianus* Trouessart, Faune Mamm. d'Europe, p. 181.

Type locality.—Pajáres, Leon, Spain.

Geographical distribution.—Austurias, and Sierra de Guadarrama, Spain. Details of distribution imperfectly known.

Diagnosis.—Larger than *Microtus arvalis* (hind foot nearly 20 mm.), though similar in all general features. Skull massive and deep, the dorsal profile strongly convex, the brain-case short and broad, the zygomata widely spreading; interorbital region with evident ridges; auditory bullæ very large. Colour about as in *M. arvalis meridianus*.

Colour.—Upper parts buffy clay-colour, rather coarsely "lined" with black along median dorsal area, clearer and more nearly approaching ochraceous-buff on sides; underparts dull grey, clear or washed with light buff; feet an indefinite buffy grey tinged with drab, not conspicuously different from colour of back; tail obscurely bicolor, buffy grey below, brownish mixed with grey above.

Skull.—The skull is larger than in *M. arvalis*, its general aspect so robust as to suggest that of a small *M. orcadensis*. Zygomata widely spreading, strongly bent downward, not conspicuously widened at middle. Dorsal profile more strongly convex than in any of the forms of *arvalis*, in this respect resembling *M. cabreræ* and *M. hartingi*; this peculiarity is due chiefly to the great depth of the skull through interorbital region. Brain-case short and broad, its general outline rather more squarish than in *M. arvalis*, and suggesting that of *M. orcadensis*. Auditory bullæ relatively as large as in *M. hartingi*, therefore noticeably exceeding those of true *arvalis*, and slightly larger than those of *levis*. Palate normal. Nasals strongly cuneate, not peculiar in form, and not in any way suggesting those of *M. cabreræ*, the posterior border sharply angular-emarginate. Temporal ridges moderately developed.

Teeth.—Except for their greater size, a character noticeable

in both incisors and molars, the teeth do not differ from those of *Microtus arvalis*. First lower molar with anterior outer re-entrant angle normally developed.

Measurements. — External measurements of type (adult female): head and body, 120; tail, 37; hind foot, 20; ear from meatus, 14. Young adult male from La Granja, Segovia, Spain: head and body, 100; tail, 38; hind foot, 19; ear from meatus, 12·8. For cranial measurements see Table, p. 707.

Specimens examined.—Seven, from the following localities in Spain:—Pajáres, Leon, 3; La Granja, Segovia, 4.

♂, 2 ♀.	Pajáres, Leon, Spain. (*N. Gonzalez.*)	O. Thomas (p). (8. 2. 9. 206.	8. 2. 9. 205–207. *Type* of species.)
2 ♂, 2 juv. al.	La Granja, Segovia.	Purchased (Escalera).	8. 7. 30. 15–18.

MICROTUS ORCADENSIS Millais.

1904. *Microtus orcadensis* Millais, The Zoologist, 4th ser., VIII, p. 244, July, 1904.
1905. *Microtus orcadensis* Major, Ann. and Mag. Nat. Hist., 7th ser., XV, p. 324, March, 1905.
1909. *Microtus orcadensis* Trouessart, Faune Mamm. d'Europe, p. 177.

Type locality. — Pomona Island, South Orkney Islands, Scotland.

Geographical distribution.—South Orkney Islands; known at present from Pomona, Rousay, Shapinshay and South Ronaldshay.

Diagnosis.—Much larger than *Microtus arvalis* (hind foot, 18 to 20 mm., condylobasal length of skull in largest individuals about 28·5 mm.); skull essentially like that of *M. arvalis* in form, but slightly broader (ratio of zygomatic breadth to condylobasal length about 60 instead of about 56), the depth of brain-case not however sensibly reduced; teeth as in *M. arvalis*, the second upper molar with no trace of postero-internal loop, the first lower molar with well developed anterior outer re-entrant angle; colour much darker than in any of the other European species with the same pattern of enamel folding, the underparts clear ochraceous-buff.

Colour.—General effect of upper parts a rich, dark brown, nearly approaching the mummy-brown of Ridgway. Individual hairs slate-black at base, those of the underfur tipped (2 mm.) with brownish ochraceous-buff, the longer hairs clear black but producing a very slight effect of "lining." On sides the colour gradually passes into the clear bright ochraceous-buff of underparts, this slightly obscured by the slaty bases of the hairs, especially on chin and throat. Feet and under surface of tail light grey tinged with ochraceous-buff. Upper surface of tail blackish.

Skull.—Except for its larger size and relatively shorter, more

widely spreading zygomatic arches, the skull differs little from that of typical *Microtus arvalis*. Central portion of zygoma noticeably widened, a character appreciable in individuals that are still evidently sub-adult and giving the bone a decidedly different appearance from the slender arch of *arvalis*. Interparietal with longitudinal diameter greater and lateral diameter less than in *arvalis*, the resulting form more sub-quadrate than in the smaller animal. Median ridge of posterior termination of palate almost invariably with evident groove along suture. Tooth-rows relatively smaller and less widely separated than in *M. arvalis*, the distance between them the same as in the smaller species. Auditory bullæ rather small relatively to size of skull, their actual measurements not much greater than in *M. arvalis*.

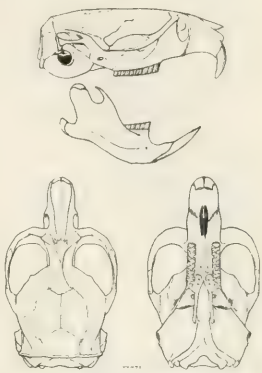

FIG. 136.
Microtus orcadensis. Nat. size

Teeth.—In structure the teeth do not differ appreciably from those of *Microtus arvalis*, though the enamel pattern in general is somewhat more compact, owing to the relatively less width of re-entrant angles and greater area of triangles. Elements of enamel pattern exactly as in *M. arvalis*; m^2 without trace of postero-internal loop; m_1 with anterior loop deeply cut on outer side by a re-entrant angle approximately as well developed as that of inner side, a character that shows no appreciable variation in a series of fifty-three skulls.

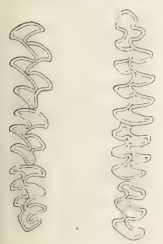

FIG. 137.
Microtus orcadensis.
Enamel pattern. × 5.

Measurements.—External measurements of type (old male), from skin: tail, 32±; hind foot, 18. Average and extremes of ten adult males from Pomona Island: head and body, 118 (113–125); tail, 38·5 (35–44); hind foot, 18·7 (18–20); ear, 12 (11–13). Average and extremes of six females from Pomona Island: head and body, 117 (114–125); tail, 38·4 (34·5–42·5); hind foot, 18·6 (18·5–19); ear, 11·5 (11–12). For cranial measurements see Table, p. 699.

Specimens examined. — Eighty, from the following islands of the South Orkney group: Rousay, 7 (B.M. and Edinburgh); Pomona, 64 (B.M., U.S.N.M. and Edinburgh); Shapinsay, 6 (Edinburgh); South Ronaldshay, 3.

Remarks.—From the other European voles with similar

enamel pattern this species is so readily distinguishable by its large size and dark colour that it needs no special comparisons. The nearest known relatives, apart from *M. sandayensis*, are *Microtus sarnius* of Guernsey and the extinct *Microtus corneri* Hinton,* from the Late Pleistocene deposits of the Ightham Fissure, Kent, and Langwith Cave, Derbyshire.

♂, 1 al. Rousay Island, Orkneys.	W. Cowan (C & P).	4. 8. 22. 1–2.
♂. Sandwick, Pomona Island.	J. G. Millais (C & P). (*Type* of species.)	4. 6. 21. 1.
6 ♂, 5 ♀. Loch Stennes, Pomona Island.	N. B. Kinnear (C & P).	5. 11. 6. 1–4. 5. 12. 3. 1–4. 6. 1. 7. 1–3.
♂, 2 ♀. S. Ronaldshay Island.	Edinburgh Museum (P).	7. 11. 16. 1–3.
♂, ♀. Orkneys.	J. G. Millais (C & P).	5. 11. 22. 1–2.

MICROTUS SANDAYENSIS Millais.

(Synonymy under subspecies.)

Geographical distribution.—North Orkney Islands, Scotland.

Diagnosis.—Like *Microtus orcadensis* but size slightly less (hind foot, 17–19 mm. ; condylobasal length of largest skulls about 27·5 mm.), and colour not so dark, the back approaching hair-brown rather than mummy-brown ; skull with brain-case noticeably flattened, auditory bullæ somewhat reduced in size, and zygoma showing little if any tendency to become expanded at middle.

Remarks.—For detailed descriptions see accounts of the two subspecies.

The voles of the North Orkney Islands are distinguished specifically from *Microtus orcadensis* of the southern group by the peculiar flattened form of the brain-case. The degrees of distinctness of the Orkney voles among themselves appear to bear a direct relation to the depth of water separating the islands, and therefore presumably to the length of time that the different colonies have been isolated. The numerous specimens of *M. orcadensis* examined from four islands of the southern group show no indication of the existence of local forms ; the depth of the channels separating these islands from each other ranges from six to eight fathoms. Between the islands inhabited by this species and those occupied by *M. sandayensis* lies a narrow but comparatively deep strait, with seventeen to twenty fathoms of water. Finally between Sanday and Westray with their different though not completely segregated forms, the depth of the water is intermediate, ten to twelve fathoms.

* Ann. and Mag. Nat. Hist., 8th ser., VI, p. 35, July, 1910. The characters by which the fossil is distinguished from *Microtus sandayensis* are less apparent than those separating the two living Orkney species.

Microtus sandayensis sandayensis Millais.

1905. *Microtus orcadensis sandayensis* Millais, Mamm. Great Brit. and Ireland, II, p. 280.
1908. *Microtus sandayensis* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 199, February, 1908.
1910. *Microtus sandayensis* Trouessart, Faune Mamm. d'Europe, p. 177.

Type locality.—Sanday Island, North Orkney Islands.

Geographical distribution.—At present known from Sanday Island only.

Diagnosis.—First lower molar with anterior outer re-entrant angle obsolete, much less developed than anterior inner angle; upper parts greyish brown, much lighter than in *M. orcadensis;* underparts whitish grey a little washed with buffy.

Colour.—General effect of upper parts a clear, light hair-brown, the individual hairs slate-black at base, those of underfur tipped with a pale buffy drab, the exact shade between the cream-buff and ecru-drab of Ridgway, the longer hairs black but producing almost no effect of "lining." Underparts light grey with a faint buffy tinge. Feet essentially like underparts. Tail not distinctly bicolor, greyish white throughout but rather strongly darkened by a sprinkling of blackish hairs along median dorsal surface.

Skull.—The skull, as already pointed out, is readily distinguishable from that of *M. orcadensis* by its lower, more flattened braincase, a character equally apparent whether the skulls are viewed from above or behind. Zygomata scarcely expanded at middle,

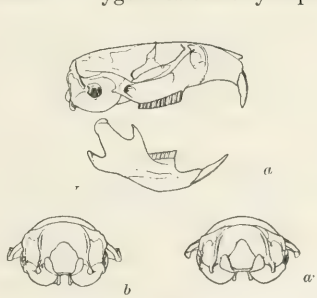

FIG. 138.

Microtus sandayensis (*a*) and (*a'*); *M. orcadensis* (*b*). Nat. size.

their form in this respect resembling that of *M. arvalis* rather than that of *M. orcadensis*. They are, however, as short and as widely spreading as in the more nearly related species. Interparietal as in *M. orcadensis*. Auditory bullæ slightly smaller than in *orcadensis*.

Teeth.—The teeth resemble those of *M. arvalis* and *M. orcadensis* except in the form of the anterior loop of the first lower molar. In both *arvalis* and *orcadensis* this loop is deeply indented by two re-entrant angles, one on each side, the two angles approximately equal in depth. In *M. sandayensis sandayensis* the inner angle remains as in the related species, but the outer, more posterior angle is much more shallow than the inner. In some specimens it is scarcely indicated, while in all of the twelve skulls that I have examined it is sufficiently different from the ordinary type to permit of certain identification of the animal by this character alone.

FIG. 139.
Microtus sandayensis sandayensis. × 5.

Measurements.—External measurements of type (immature male measured on dried skin): head and body, 86; tail, 19; hind foot, 17·4. Adult male and two adult females from the type locality: head and body, 117, 110 and 111; tail, 37·5, 38·5 and 35; hind foot, 19, 18 and 18; ear from meatus, 11, 10·5 and 11. For cranial measurements see Table opposite.

Specimens examined.—Twenty, all from Sanday Island, North Orkneys (B.M., U.S.N.M. and Edinburgh).

♀.	Sanday Island, Orkneys.	J. G. Millais (c & p).	5. 11. 22. 3. (*Type* of species.)
2 ♀.	Sanday.	N. B. Kinnear (c & p).	6. 11. 18. 7–8.
4 ♂ 4 ♀.	Sanday.	W. R. Ogilvie-Grant (c & p).	11. 11. 2. 1–8.

MICROTUS SANDAYENSIS WESTRÆ Miller.

1908. *Microtus sandayensis westræ* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 199, February, 1908.
1910. *Microtus sandayensis westræ* Trouessart, Faune Mamm. d'Europe, p. 178.

Type locality.—Westray Island, North Orkney Islands.

Geographical distribution.—At present known from Westray Island only.

Diagnosis.—First lower molar with anterior outer re-entrant angle occasionally as deep as in *M. orcadensis;* colour not so pale as in the Sanday vole, the underparts strongly washed with yellowish brown.

Colour.—General effect above a dark hair-brown approaching bister, the arrangement of colour as in *sandayensis*, but light tips to hairs of underfur more nearly a dull ochraceous-buff, and dark shading from longer hairs more noticeable. Underparts light ochraceous-buff, nearly as in *M. orcadensis*, but colour not so rich and clouding from slaty bases of hairs more evident. Feet and tail as in *sandayensis*, but sprinkling of dark hairs on upper surface of tail more conspicuous.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Occipital breadth.	Occipital depth.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
M. orcadensis.													
Orkney Islands: Rousay Island .	4. 8. 22. 1		27·0	16·6	4·0	12·4	6·8	8·2	8·0	17·8	6·6	6·4	Ridges scarcely visible.
,, .	356 Kinnear	♂	30·0	17·8	3·6	12·6	7·2	9·0	9·6	19·2	7·0	7·0	Old.
,, .	359 ,,	♀	28·6±	17·4	4·2	—	—	8·8	9·0	18·4	6·6	6·6	Fully adult.
Pomona Island .	4. 6. 21. 1*	♂	28±	17·0	4·0	12·0	6·4±	8·8	8·2	18·0	6·8	6·6	Old. Ridges joined.
,, .	5. 11. 6. 2	♂	27·8	16·4	4·0	12·2	7·0	9±	8·6	17·4	6·8	6·4	Ridges nearly joined.
,, .	214 Kinnear	♂	27·8	16·4	4·0	—	—	8·2	8·8	18·0	6·8	6·8	
,, .	219 ,,	♂	27·2	16·4	4·0	12·8	7·0	8·0	8·4	18·4	6·6	6·4	
,, .	222 ,,	♂	28·4	17·2	3·8	12·8	7·0	8·4	8·4	18·6	6·8	6·6	
,, .	5. 11. 6. 4	♀	28·0	16·4	4·0	12·2	7·0	8·4	8·0	18·0	6·6	6·6	
,, .	209 Kinnear	♀	27·4	16·8	4·0	12·2	6·8	8·2	8·0	18·0	6·8	6·8	
,, .	211 ,,	♀	28·0	16·4	4·0	12·2	7·0	8·4	8·2	17·8	6·8	6·8	
,, .	223 ,,	♀	27·6	16·4	4·0	12·0	7·0	8·4	8·2	17·8	6·8	6·6	
,, .	267 ,,	♀	27·6	16·2	3·8	12·0	6·8	8·0	8·2	18·2	6·6	6·6	
Shapinshay . .	352 ,,	♀	28±	17±	4·0	—	—	8·6	8·8	18·6	6·8	7·0	
South Ronaldshay	7. 11. 16. 1	♂	29·6	17·8	4±	13·0	7·2	9·8	9·0	18·8	6·8	6·8	
M. sandayensis sandayensis.													
Orkney Islands: Sanday Island .	6. 11. 18. 7	♀	25·2	15·0	3·2	11·0	5·8	7·8	7·8	17·0	6·2	6·2	Ridges scarcely visible.
,, .	5. 11. 22. 3*		—	—	3·8	—	—	7·2	7·2	16·0	6·0	6·0	Immature.
,, .	254 Kinnear	♀	27·2	16·8	3·4	12·0	6·0	8·4	8·2	18·0	7·0	6·8	Fully adult.
M. sandayensis westræ.													
Orkney Islands: Westray Island .	290 ,,	♂	27·2	16·2	3·6	12·0	6·4	7·8	8·2	17·4	6·6	6·8	
,, .	8. 1. 2. 1*	♀	27·6	16·8	3·4	11·8	6·6	8·8	8·4	18·4	6·8	6·6	Old.
,, .	335 Kinnear	♀	26·8	—	3·6	12·0	6·4	—	8·4	17·6	6·4	6·6	Fully adult.

* Type.

Skull.—The skull so exactly resembles that of *Microtus sandayensis sandayensis* as to require no detailed description. Even in a very old individual (Kinnear No. 321) the zygoma shows no indication of the central expansion characteristic of *M. orcadensis*.

Teeth.—The anterior loop of the first lower molar is intermediate in form between that of *orcadensis* and true *sandayensis*, though apparently nearer the latter. The outer re-entrant angle tends to be shallow, so that its depth is usually much less than that of inner angle, but the degree of this flattening varies so much that specimens cannot be identified by this character alone, while in at least one specimen (No. 321 Kinnear) the conditions are exactly as in *M. orcadensis*.

Measurements.—External measurements of type (adult female): head and body, 108; tail, 33; hind foot, 17; ear from meatus, 12. Adult male and female from the type locality: head and body, 115 and 108; tail, 42 and 38; hind foot, 18 and 17; ear from meatus, 11 and 11. For cranial measurements see Table, p. 699.

Specimens examined.—Seven, all from Westray Island, North Orkneys (B.M. and Edinburgh).

♂. Westray Island, Orkneys. N. B. Kinnear (C & P). 8. 1. 2. 1. (*Type* of subspecies.)

MICROTUS SARNIUS Miller.

1909. *Microtus sarnius* Miller, Ann. and Mag. Nat. Hist., 8th ser., III, p. 420, May, 1909.

1910. *Microtus sarnius* Trouessart, Faune Mamm. d'Europe, p. 178.

Type locality.—St. Martins, Guernsey, Channel Islands.

Geographical distribution.—Island of Guernsey.

Diagnosis.—Size about as in *Microtus orcadensis* or slightly less (hind foot about 18·5 mm., condylobasal length of skull about 28 mm.); skull narrower than that of *orcadensis*, its appearance in old individuals essentially as in the larger races of *M. agrestis;* colour *agrestis*-like, the underparts sharply contrasted pale grey.

Colour.—The colour in summer in practically identical with that of *Microtus agrestis agrestis*, though perhaps in most specimens somewhat less dark and reddish. Underparts a light grey (about the grey No. 9 of Ridgway) strongly contrasted with wood-brown of sides, the belly sometimes with a faint buffy tinge, the slate-grey appearing irregularly at surface, especially in abraded skins.

Skull.—In fully adult skulls the size and general appearance is essentially as in the large forms of *Microtus agrestis*, though the interorbital region is both longer and wider, the brain-case is more depressed posteriorly, and the interparietal is noticeably more quadrate in form, its antero-posterior diameter distinctly more than half transverse diameter, its lateral extremities

squarely truncate. In younger specimens (temporal ridges evident, but not joined) the brain-case is broader and the general form more nearly approaches that of *M. orcadensis* at the same stage, though the zygomata are longer and less abruptly spreading, and the auditory bullæ are smaller.

Teeth.—In all respects except for their slightly smaller size the teeth resemble those of *Microtus orcadensis*. First lower molar with well developed antero-external re-entrant angle.

Measurements.—External measurements of type (adult male): head and body, 118; tail, 42; hind foot, 18·5; ear from meatus, 12. Adult male and female from the type locality: head and body, 115 and 114·5; tail, 44 and 34; hind foot, 18·4 and 17·5; ear from meatus, 9·5. For cranial measurements see Table, p. 707.

Specimens examined.—Fourteen, all from the island of Guernsey.

Remarks.—Misled by the extreme narrowness of the very aged type skull, I at first supposed this animal to be a member of the *agrestis* group with aberrant dentition. Further material shows that it is related to the voles of the Orkney Islands and to the extinct *Microtus corneri* of the British mainland, the three living species and their fossil relative apparently belonging to an older fauna than that now inhabiting Great Britain and the mainland of Europe.*

4 ♂, 1 ♀. St. Martins, Guernsey. (*R. H. Bunting.*)	O. Thomas (p).	8. 9. 2. 24–28. (8. 9. 2. 27. *Type* of species.)

MICROTUS CABRERÆ Thomas.

1906. *Microtus cabreræ* Thomas, Ann. and Mag. Nat. Hist., 7th ser., xvii, p. 576, June, 1906.
1910. *Microtus cabrerai* Trouessart, Faune Mamm. d'Europe, p. 181.

Type locality.—Rascafria, south side of Sierra de Guadarrama, Province of Madrid, Spain.

Geographical distribution.—Probably throughout the mountainous region of central Spain, but at present only known with certainty from the type locality.

Diagnosis.—A large member of the *arvalis* group, equal in size to *M. orcadensis* (hind foot, 22 mm.; condylobasal length of skull, 27 mm.). Readily distinguishable from all its allies by the strongly convex dorsal profile of the skull, deep, rounded brain-case, slightly tapering nasals and (in young adult skulls at least) the conspicuous longitudinal furrow in interorbital region. Externally the type is peculiar in the unusual length and conspicuousness of the longer hairs above, those of the sides and rump with noticeable pale tips or sub-terminal annulations.

Colour.—Hairs of upper parts slate-colour at base, those of

* See Hinton, Ann. and Mag. Nat. Hist., 8th ser., vi, p. 36, July, 1910.

the underfur a dull, buffy wood-brown (2 mm.) at tip, the longer hairs black, those of sides and rump with conspicuous buffy tips or sub-terminal areas about 4 mm. in length. In both specimens the long hairs are more conspicuous than in any other European *Microtus* that I have examined. On sides the buffy wood-brown is nearly clear and distinctly more yellow than the cream-buff of Ridgway, but on back it is coarsely and conspicuously "lined" with black, the general effect of the two colours approaching olive or bister. Underparts yellowish cream-buff irregularly clouded by the slaty bases of hairs. Feet a dull, light, brownish buffy. Tail obscurely bicolor, pale buffy below, dull brownish above.

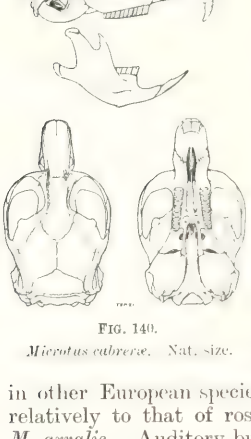

FIG. 140.

Microtus cabreræ. Nat. size.

Skull.—The skull differs from that of all other known European species of *Microtus* in its very highly arched brain-case, which gives the dorsal profile a uniform convexity that is exceedingly characteristic. Interorbital region, in the two skulls examined, rather broad, with distinct median longitudinal concavity and low but evident lateral ridges.* Nasals slightly tapering, their width posteriorly about three-fourths that anteriorly, their posterior termination square, slightly exceeded by nasal branch of premaxillary. In both of the skulls examined the length of nasal decidedly surpasses that of diastema, a condition not observed in other European species. Palatal foramina large, their width relatively to that of rostrum greater than in *M. arvalis*. Auditory bullæ not peculiar, their size relatively about as in *M. arvalis*.

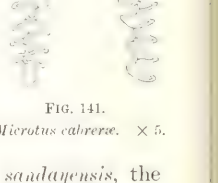

FIG. 141.

Microtus cabreræ. × 5.

Teeth.—The teeth are strictly of the *M. arvalis* type. Terminal loop of both m^3 and m_1 shortened as compared with the other European members of the *arvalis* group, so that in the former the third inner re-entrant angle is very shallow, and the extreme posterior portion of the tooth is a nearly straight loop, almost as wide as long, and evenly constricted from both sides proximally, while in the latter the outer re-entrant angle is practically absent, this peculiarity being carried to a greater extreme than in *M. sandayensis sandayensis*, the only other European *Microtus* in which it is known to occur

* The ridges may eventually unite; but the form of the interorbital region in the young adult is different from that in any of the other European species at the same stage.

as a normal character. Upper incisors short, directed downward and slightly backward, concealed by nasals when skull is viewed from above.

Measurements.—External measurements of type: head and body, 107; tail, 34; hind foot, 22; ear from meatus, 12. For cranial measurements see Table, p. 707.

Specimens examined.—Two, the type, from near Rascafria, in the Sierra de Guadarrama, Madrid, Spain, and a second specimen without definite locality.

♂. Rascafria, Sierra de Guadarrama, Spain.	M. de la Escalera (c).	6. 11. 4. 9. (*Type* of species)
sk. Spain.	Purchased (Parzudaki).	53. 12. 6. 31.

MICROTUS DENTATUS Miller.

1910. *Microtus cabreræ* Cabrera, Asoc. Españ. Progr. Cien., Congr. Zaragosa, 1908, p. 49, June, 1910 (part).

1910. *Microtus dentatus* Miller, Ann. and Mag. Nat. Hist., 8th ser., VI, p. 459, November, 1910. Type in Madrid Museum.

Type locality.—Molinicos, Sierra de Segura, Albacete, Spain.

Geographical distribution.—Known only from the Sierra de Segura.

Diagnosis.—Similar to *Microtus cabreræ* of the Sierra de Guadarrama, but larger, the skull about 30 mm. in condylobasal length; teeth excessively heavy, the molars larger than in any other known European *Microtus*, the length of maxillary toothrow 8 mm.; m_3 with a completely closed triangle on outer side.

Colour.—Like that of *M. cabreræ*, but noticeably less buff, the ground colour of back and sides not so yellow as the cream-buff of Ridgway, the general effect a peculiar buffy grey much paler than the olive or bister of *cabreræ;* underparts light grey scarcely tinged with buff; no evident line of demarcation along sides.

Skull.—The only known skull is imperfect, lacking the auditory bullæ and base of brain-case. It is that of an individual slightly older than the type of *Microtus cabreræ*, but of about the same age as the fragmentary skull of No. 55. 12. 6. 31. Size conspicuously greater than in either of these; general form the same, but dorsal profile less concave than in the type, especially over posterior half of brain-case; rostrum much heavier than in *M. cabreræ*, the incisive foramina fully 1½ times as wide though of about the same length; relative lengths of nasal and diastema, and form and position of posterior border of nasals as in *M. cabreræ;* interorbital region longer and narrower, but lateral ridges and median groove not peculiar. Mandible as in *M. cabreræ*, the base of articular process scarcely thickened by upward extension of incisor root, the dental foramen lying almost at extreme posterior edge.

Teeth.—In general the teeth are like those of *Microtus cabreræ*,

but are immediately distinguishable by the unusually large size of the molars. Posterior loop of m^3 and anterior loop of m_1 rather short ; most of the triangles showing an exaggeration of the

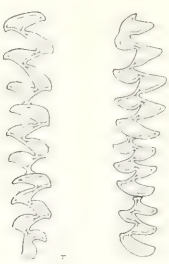

FIG. 142.

Microtus dentatus. × 5.

tendency to flattening characteristic of *cabreræ ;* m_2 with a large, completely closed triangle on outer side.

Measurements.—External measurements of type : head and body, 125 ; tail, 40 ; hind foot (dry), 22. For cranial measurements see Table, p. 707.

Specimen examined.—The type (Madrid).

MICROTUS HARTINGI Barrett-Hamilton.

1903. *Microtus* (*Microtus*) *hartingi* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., XI, p. 307, March, 1903. Type in British Museum.
1910. *Microtus hartingi* Trouessart, Faune Mamm. d'Europe, p. 174.

Type locality.—Larissa, Thessaly, Greece.

Geographical distribution.—Known only from the vicinity of Larissa.

Diagnosis.—Size large, slightly exceeding that of *Microtus orcadensis* and *M. cabreræ* (hind foot about 18, condylobasal length of skull about 29 mm.) ; tail relatively short ; colour more yellowish than in any of the European forms of *M. arvalis ;* skull with rather deep brain-case and slightly convex dorsal profile ; teeth as in *M. arvalis*, but triangles narrower relatively to their width, and area of dentine spaces reduced as compared with thickness of enamel.

Colour.—Back and sides a light dull buff, perhaps nearest the pinkish buff of Ridgway, clear on flanks and thighs, but elsewhere grizzled by the blackish tips of the longer hairs, these most numerous over posterior half of back ; underparts, feet, and tail buffy white, the dorsal surface of tail slightly more yellow

(about concolor with flanks), the belly irregularly clouded by the slaty bases of the hairs.

Skull.—The skull, though heavier and more massive than in any of the European members of the *M. arvalis*, has much the same general outline as in typical *arvalis*. The brain-case is, however, relatively deeper anteriorly, so that the dorsal profile is convex throughout (though much less so than in the Spanish *M. cabreræ*). Interorbital region with slight median longitudinal groove and low lateral ridges which do not tend to become united in any of the four skulls examined. Nasals strongly tapering posteriorly as in *M. arvalis*, their termination a little emarginate and slightly exceeded by nasal branches of pre-maxillaries. Palatal foramina narrow, as in *M. arvalis*. Auditory bullæ not peculiar in form, their size relatively somewhat greater than in *M. arvalis*.

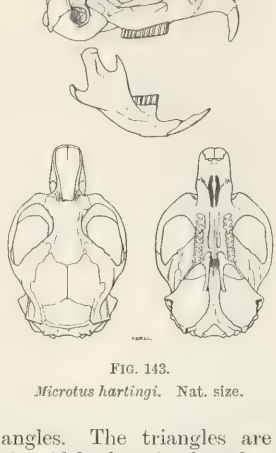

FIG. 143.
Microtus hartingi. Nat. size.

Teeth.—While preserving the typical *arvalis* pattern, the teeth are peculiar in a certain disjointed appearance of the prisms, due to the great depth of the re-entrant angles. The triangles are rather narrower in proportion to their width than in the other members of the *arvalis* group, and the dentine spaces have the appearance of being reduced in proportion to the thickness of the enamel, a character difficult to define but readily appreciable to the eye. Except for these general peculiarities the molars closely agree with those of *M. arvalis*. First lower molar with normal anterior loop, the outer re-entrant angle well developed and approximately as deep as inner angle. Posterior upper molar with the same elements as in *M. arvalis*.

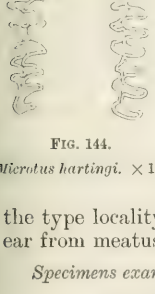

FIG. 144.
Microtus hartingi. × 10.

Measurements.—External measurements of type (adult male): head and body, 107; tail, 26; hind foot, 18. A second adult male from the type locality: head and body, 115; tail, 27; hind foot, 18; ear from meatus, 10. For cranial measurements see Table, p. 707.

Specimens examined.—Eight, all from the type locality.

Remarks.—Though very different from the other European species of *Microtus*, this animal is nearly related to *M. guentheri*

Danford and Alston, of Asia Minor. It differs merely in its slightly paler, more yellowish colour, somewhat more robust skull, and more inflated auditory bullæ.

♂, 2 al.	Larissa, Thessaly, Greece.	J. E. Harting (P). (93. 4. 5. 1. *Type* of species.)	93. 4. 5. 1–3.
♂ al.	Larissa, Thessaly.	P. H. Mavrogordato (C & P).	93. 3. 28. 1.
♂, ♀, 2 juv. al.	Thessaly.	Dr. F. Loeffler (C & P).	92. 12. 7. 1–4.

MICROTUS ANGULARIS Miller.

1908. *Microtus angularis* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 198, February, 1908. Type in British Museum.

1910. *Microtus angularis* Trouessart, Faune Mamm. d'Europe, p. 182.

Type locality.—Transylvania (probably near Hatszeg, Hunyad, Hungary).

Geographical distribution.—Known only from the type locality.

Diagnosis.—A large member of the *Microtus arvalis* group, about equal to the Grecian *M. hartingi* in size, but with much longer tail; skull with unusually deep rostrum and abruptly sloping nasals.

Colour.—After about thirty years immersion in alcohol the type appears to be essentially like *Microtus arvalis arvalis* in colour.

Skull and teeth.—The skull differs from that of all other known European species of *Microtus* in the very deep, relatively short rostrum (depth at back of nasal decidedly greater than distance between front of zygoma and anterior extremity of nasal) and the unusually conspicuous angle (about 34° instead of about 18° to 22° as in *M. arvalis*, *M. hartingi* and *M. orcadensis*) at which the nasals slope downward. Auditory bullæ relatively larger than in *M. arvalis*, but not so much inflated as in *M. hartingi*. Form of brain-case not known. Teeth with pattern of enamel folding as in *Microtus arvalis*, but all of the triangles, especially those in lower molars, with transverse diameter noticeably increased relatively to antero-posterior diameter, and area of dentine spaces reduced.

FIG. 145.
Microtus angularis.
Nat. size.

Measurements.—Type (adult male, in spirit): head and body, 115; tail, 41; hind foot, 18; ear from meatus, 12. For cranial measurements see Table opposite.

Specimen examined.—The type.

♂ al.	Transylvania.	C. G. Danford (C & P). (*Type* of species.)	80. 10. 28. 2.

CRANIAL MEASUREMENTS OF *MICROTUS SARNIUS*, *M. ASTURIANUS*, *M. CABRERÆ*, *M. HARTINGI* AND *M. ANGULARIS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Occipital breadth.	Occipital depth.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
M. sarnius.													
Channel Islands: Guernsey	8. 9. 2. 24*	♂	27·8	16·0	3·8	11·8	6·4	7·8	8·2	17·4	6·8	6·8	Ridges joined.
,,	153007	♂	—	15·8	3·8	—	—	8·0	7·8	17·0	6·6	6·8	,, nearly joined.
,,	172336	♀	—	—	3·8	—	—	8·0	7·8	17·6	6·8	7·0	,, ,,
,,	172345	♀	—	15·0	3·8	—	—	7·6	7·4	16·6	6·6	6·6	,, nearly joined, low.
M. asturianus.													
Spain: Pajáres, Leon	8. 2. 9. 206*	♀	26·2	15·2	3·2	12·2	6·4	7·8	7·8	16·6	6·6	6·4	,, nearly joined.
La Granja, Segovia	8. 7. 30. 16	♂	25·4	14·2	3·2	11·8	6·6	7·2	7·8	17·0	6·4	6·2	Young adult.
M. cabreræ.													
Spain: Rascafria, Madrid	6. 11. 4. 9*	♂	27·0	16·0	3·4	12·2	7·0	9·2	8·0	18·0	6·8	6·8	Upper length 26·6.
no exact locality	53. 12. 6. 31		—	16·0	3·2	—	—	9·0	8·0	17·6	7·0	7·2	Fully adult.
M. dentatus.													
Spain: Molinicos, Albacete	Madrid 2031*	♀	30±	—	3·2	—	—	9·8	8·8	19·0	8·0	7·6	Upper length 29·4.
M. hartingi.													
Greece: Larissa, Thessally	92. 12. 7. 2	♀	28·4	17·4	3·4	13·4	7·0	8·0	8·6	18·4	7·0	7·0	Adult.
,, ,,	93. 4. 5. 2	♂	29·0	16·8	3·6	13·6	7·0	7·8	8·8	18·0	6·8	6·8	,,
,, ,,	93. 4. 5. 3	♂	29·2	17·0	3·8	13·4	7·0	7·8	8·6	18·4	7·0	7·0	,,
M. angularis.													
Austria-Hungary: Hatszeg, Hunyad	80. 10. 28. 2*	♂	27±	16·4±	4±	13·0	7·6±	8·0	8·4	17·4±	6·6	6·4	Fully adult.

* Type.

MICROTUS RATTICEPS Keyserling and Blasius.

1841. *Arvicola ratticeps* Keyserling and Blasius, Mem. présentés à l'Acad. Imp. des Sci. Nat. de St. Pétersbourg, IV, livr. 3, p. 333, 1841 (date on title-page of completed volume, 1845). (Welikii-Ustjug, north-central Russia.)

1841. *Arvicola arenicola* de Sélys-Longchamps, Bull. de l'Acad. Royale des Sci. des Arts et Belles-Lettres de Bruxelles, VIII, pt. 2, p. 236 (Lisse, near Leiden, Holland. See Jentink, Notes from the Leiden Museum, XXIX, p. 263, February 29, 1908).

1844. *Arvicola medius* Nilsson, Öfversigt af Kongl. Vetenskaps-Akademiens Förhandlingar, Stockholm, I, p. 34, March 20, 1844 (Lapland, and the mountains about the Gudbrandsdal, Norway).

1857. *Arvicola ratticeps* Blasius, Säugethiere Deutschlands, p. 365.

1887. *Microtus ratticeps* Lataste, Ann. Mus. Civ. Stor. Nat. Genova, 2nd ser., IV, p. 265, January, 1887.

1899. *Arvicola* (*Microtus*) *ratticeps* var. *stimmingi* Nehring, Sitz.-Ber. Gesellsch. Naturforsch. Freunde, Berlin, p. 58 (near Brandenburg, Germany). See Rörig, Arbeiten aus der Kais. Biol. Anstalt für Land- und Forstwirtschaft, VII, p. 471, 1909.

1910. *Microtus ratticeps*, *M. ratticeps stimmingi*, and *M. arenicola* Trouessart, Faune Mamm. d'Europe, p. 179.

Type locality.—Welikii-Ustjug, on the Dwina River, north-central Russia.

Geographical distribution. Northern portions of continental Europe and Asia from northern Russia and the mountains of Scandinavia eastward into Siberia, south to Holland,* northern Germany and northern Hungary.

Diagnosis.—Size large (hind foot, 19–21 mm.; condylobasal length of skull in largest individuals, 30 mm.); second upper molar without postero-internal triangle; first lower molar with only three re-entrant angles on outer side; skull long and slender (ratio of zygomatic breadth to condylobasal length about 50), the intertemporal region developing moderate ridge with age; length of brain-case measured from interorbital constriction to condyle greater than zygomatic breadth.

External characters.—Essentially as in *Microtus agrestis*, but thumb usually with somewhat better developed nail, and sole with sixth tubercle relatively smaller.

Colour.—In general the colour is not essentially different from that of *Microtus agrestis*, though it shows a tendency to be somewhat darker. Upper parts a coarse mixture of wood-brown and black, the sides occasionally with a slight tinge of russet. Underparts abruptly defined pale grey tinged with cream-buff and frequently darkened by slaty under-colour. Feet light drab or dull whitish. Tail rather sharply bicolor, dark brown above, whitish below. In a skin from Western Hungary (B.M. 94. 3. 1. 64) there is a noticeable dark dorsal area extending from forehead to base of tail, rather sharply defined clear

* Not known to occur in Denmark (*see* Winge, Danmarks Fauna, Pattedyr, p. 78, 1908).

blackish brown on nape, elsewhere a mere darkening of normal colour.

Skull.—The skull attains a greater length than that of *Microtus agrestis*, but the zygomatic breadth and breadth of brain-case scarcely if at all exceed the corresponding dimensions in the smaller animal, so that the general form is conspicuously less robust. Dorsal, ventral and occipital profiles essentially as in *M. agrestis*, except that there is usually a slight concavity in interorbital region, and the contrast between occipital and rostral depths is less pronounced. Brain-case long and narrow, slightly oval in outline, the moderately developed postorbital processes not sufficiently prominent to cause the anterior portion to appear square ; upper surface rather strongly arched laterally, not flattened as in *M. agrestis ;* lateral ridges moderately developed ; interparietal relatively small, its area distinctly less than half that of parietal, its general outline almost evenly biconvex except for a slight median projection on anterior border ; occiput when viewed from behind essentially as in *M. agrestis*, but more rounded above ; floor of brain-case without special peculiarities, but region of basal suture depressed rather than elevated (as in *M. agrestis*) when skull is held upside down ; auditory bulla somewhat larger and more inflated than in *M. agrestis*, but not peculiar in form. Interorbital region narrow as in *M. agrestis*, but more elongated. Zygomata standing out from sides of skull noticeably less than in *M. agrestis* and *M. arvalis ;* median expansion well defined, rather more abrupt than usual ; infraorbital foramen wide, its lower border less extended downward behind root of incisor than in *Microtus agrestis* and *M. arvalis*. Rostrum with no special peculiarities ; nasals terminating posteriorly on level with nasal branches of premaxillaries a little in front of middle of zygomatic root ; incisive foramina shorter than in *M. agrestis*, strongly contracted posteriorly, terminating a little in front of level of alveolus of m^1. Bony palate with no special peculiarities, but lateral pits rather small, and median sloping ridge broad and flat, somewhat as in the sub-genus *Chionomys*. Mandible as in *M. agrestis*, but more slender.

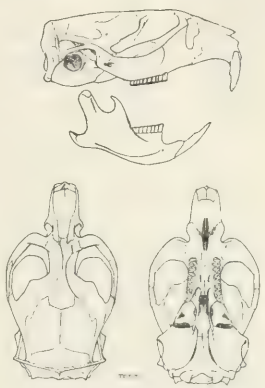

FIG. 146.

Microtus ratticeps. Nat. size.

Teeth.—Incisors essentially as in *Microtus agrestis*, but front face of upper teeth less obliquely rounded off at outer side. Size of molars relatively to that of skull about as in *Microtus*

agrestis or perhaps a trifle less. Enamel pattern agreeing with that of *M. arvalis* in the absence of all trace of a postero-internal loop in m^2, as well as in the characters of m^1, m_2 and m_3, common to nearly all the European members of the sub-genus; there is everywhere, however, less contrast in size and depth between the inner and outer angles and triangles. Third upper molar frequently of the more complicated type described under *M. agrestis*, the posterior loop with its inner limb isolated as a definite, well-developed, second inner closed triangle, and the projection on its outer side tending to assume the form of a small but almost closed third outer triangle. First lower molar highly characteristic and readily distinguishable from that of all the other European members of the sub-genus; posterior loop, three inner and two outer closed triangles as in *M. agrestis*, except for the less contrast in size between the elements of outer and inner side; anterior loop so short that it bears no re-entrant angle on outer side, while that of inner side is reduced to a shallow, inconspicuous concavity, some trace of which is, however, apparently always present; angle subtending terminal loop on outer side broad and rather shallow; antero-internal triangle usually communicating with anterior loop, this communication when broadly open frequently converting the two elements into a secondary terminal loop of irregularly crescentic form not unlike some of the variants of posterior loop of m^3. While differing conspicuously from that of the other European species of true *Microtus* this tooth is essentially like that of the members of the sub-genus *Chionomys*. Isolated specimens may usually be distinguished by the less contrast between size of inner and outer triangles, and by the absence of any conspicuously projecting angle at outer base of anterior loop; in certain forms of *Chionomys*, however, the latter peculiarity is almost exactly reproduced.

FIG. 147.
Microtus ratticeps.
Enamel pattern. × 5.

Measurements.—Average and extremes of nine adults from Lappmark, Sweden: hind foot (dry), 19·9 (19·4–21). Adult from Csallóköz-Somorja, Pressburg, Hungary: hind foot, 20·8. Adult female from Texel Island, Holland: head and body, 130; tail, 62; hind foot, 20; ear, 13. For cranial measurements see Table opposite.

Specimens examined.—Twenty-eight, from the following localities:—
NORWAY.—Gausdal, 4; Hjerkin, Kristiansamt, 1; Dovre Fjeld, 1 (U.S.N.M.).
SWEDEN.—Medelpad, W. Norrland, 1; Karesuando, Norrbotten, 3; Lappmark, 5 (B.M. and U.S.N.M.; near Stockholm, 1 (U.S.N.M.).
FINLAND.—Muonionniska, Uleaborg, 5 (B.M. and U.S.N.M.).
GERMANY. Colpin, Brandenburg, 1; near city of Brandenburg, 1 (Berlin Agric.; cotype of *stimmingi* Nehring).
AUSTRIA-HUNGARY.—Csallóköz-Somorja, Pressburg, Hungary, 1.

CRANIAL MEASUREMENTS OF *MICROTUS RATTICEPS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Occipital breadth.	Occipital depth (median).	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
Finland: Muonionniska, Uleaborg	49. 11. 1. 9		—	15·4	3·6	—	—	8·4	9·2	18·8	7·0	7·0	
,, ,,	49. 11. 1. 21		28·8	16·0	3·8	11·6	7·0	8·0	9·0	—	7·0	7·0	
,, ,,	90. 8. 1. 17		30·0	16·0	3·2	12·4	7·0	8·8	9·0	18·8	6·8	6·8	
,, ,,	37732		28·6	15·6	4·0	—	7·0	7·6	8·8	18·2	6·8	6·6	Ridges nearly joined.
,, ,,	6622 Merriam		28·4	15·2	3·8	12·4	6·8	7·8	9·2	18·2	6·8	6·8	,, ,,
Sweden: Karesuando, Norrbotten	6635 ,,	♂	—	—	—	—	—	7·4	9·4	18·4	6·8	6·8	,, ,,
,, ,,	6638 ,,	♂	29·6	16·0	4·0	—	7·0	7·6	9·2	19·0	6·8	6·8	,, joined, low.
,, ,,	6636 ,,	♀	28·8	15·8	3·8	12·6	7·0	7·4	9·2	19·0	6·6	6·6	,, ,,
near Stockholm	1055 U.S.N.M.	♀	30·0	15·6	4·0	12·4	7·0	8·4	9·4	18·2	7·0	7·0	,, ,,
Lapland	1056 ,,		27·6	15·0	3·6	12·2	6·8	7·8	8·6	17·8	6·6	6·4	,, nearly joined, low.
,,	6598 Merriam		29·6	16·2	4·0	13·0	7·0	9·0	9·6	18·8	7·0	6·8	,, joined, low.
Norway, Dovre	7. 7. 7. 4535	♀	27·6	15·6	3·6	12·4	6·8	7·8	8·4	17·4	6·4	6·2	,, ,,
Gausdal	7. 7. 7. 4536	♂	—	—	—	—	—	8·0	9·0	—	6·8	6·8	,, ,,
Holland: Texel Island	8. 10. 26. 3	♀	29·0	16·2	3·4	13·0	6·8	8·2	8·8	17·6	6·8	6·4	,, nearly joined.
Germany: Colpin, Brandenburg	81. 10. 7. 1	♀	27·5	15·5	3·5	—	—	8·0	8·6	17·0	6·8	6·8	Immature.

Holland.—Lisse, near Leiden, 4 (Leiden; cotypes of *arenicola* de Sélys-Longchamps); Texel Island, 1.

3 ♂.	Gausdal, Norway.	Christiania Museum (E).	93. 3. 1. 11, 13.
♂.	Gausdal.	Miller Collection.	7. 7. 7. 4536.
♀.	Hjerkin, Kristiansamt.	Miller Collection.	7. 7. 7. 4535.
1.	Medelpad, W. Norrland, Sweden.	Prof. Sundevall (P).	49. 11. 1. 21.
1.	Torneå, Lappmark, Sweden.	Prof. Sundevall (P).	45. 10. 25. 10.
1.	Lapland.	Prof. Sundevall (P).	49. 11. 1. 9.
2.	Lapland.	Tomes Collection.	7. 1. 1. 141–142.
1.	Lapland.	Miller Collection.	7. 7. 7. 3250.
1.	Muonionniska, Uleaborg, Finland.	Stockholm Museum (E).	90. 8. 1. 7.
♂.	Texel Island. Holland.	J. L. Bonhote (C & P).	8. 10. 26. 3.
1 al.	Colpin, Brandenburg, Germany.	C. Gadow (C & P).	81. 10. 7. 1.
2.	Csallóköz-Somorja, Pressburg, Hungary.	Budapest Museum (E).	94. 3. 1. 64–5

Sub-Genus **CHIONOMYS** Miller.

1857. *Paludicola* Blasius, Säugethiere Deutschlands, p. 334 (part). Not of Wagler, 1830.

1867. *Praticola* Fatio, Les Campagnols du Bassin du Léman, p. 34 (part). Not of Swainson, 1837.

1896. *Microtus* Miller, North American Fauna, No. 12, p. 62, July 23, 1896 (part).

1908. *Chionomys* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 97, January, 1908.

Type species.—*Arvicola nivalis* Martins.

Geographical distribution.—Mediterranean region from the Pyrenees to the Caucasus and Asia Minor, mostly in or near mountains.

Characters.—In general like the sub-genus *Microtus*, but third upper molar with only two re-entrant angles on each side, as in *Arvicola* and some forms of *Pitymys*; skull with broad, rather flat, smooth brain-case, and wide interorbital region, the temporal ridges low and inconspicuous; posterior termination of palate essentially as in true *Microtus*, but with elements usually less well-defined.

Remarks.—The sub-genus *Chionomys* is a very natural group, whose characters, while for the most part agreeing with those of true *Microtus*, show a distinct tendency toward *Arvicola* and *Pitymys*. Seven forms are now known, all but two of which occur in Europe. One of these inhabits the lowlands of southern France, but all of the others are characteristic mountain animals. The general appearance of the members of this group is highly characteristic as compared with that of the other European species of *Microtus*. They are medium-sized, rather long-tailed voles with a peculiar slaty greyish general colour, and full, soft fur, the tail often mostly or entirely whitish.

KEY TO THE EUROPEAN MEMBERS OF THE SUB-GENUS *CHIONOMYS*.

Hind foot in adults less than 20 mm.; back clear light grey or with very slight brownish tinge; tail always white throughout ..... *M. lebrunii*, p. 718.
Back clear light grey; auditory bullæ small and flattened (Neighbourhood of Nîmes, Gard, France) ..... *M. l. lebrunii*, p. 719.
Back with slight brownish tinge; auditory bullæ large and strongly inflated (normal) (Basses-Alpes) ..... *M. l. leucurus*, p. 722.
Hind foot in adults 20 mm. or more; back decidedly brownish; tail often not entirely white.
Posterior termination of palate with median ridge sharply defined, its width less than that of deep lateral pit; back rather heavily clouded with blackish; tail usually dark above (Transylvanian Alps) ..... *M. ulpius*, p. 723.
Posterior termination of palate with median ridge usually not sharply defined, its width always at least equal to that of shallow lateral pit; back slightly or not clouded with blackish; tail not usually dark above ..... *M. nivalis*, p. 713.
Anterior loop of first lower molar with postero-external salient angle usually narrow and sharply pointed, never obsolete (Alps and Apennines) ..... *M. n. nivalis*, p. 716.
Anterior loop of first lower molar with postero-external salient angle usually broad and rounded, sometimes obsolete (Pyrenees) ..... *M. n. aquitanius*, p. 717.

MICROTUS NIVALIS Martins.

(Synonymy under subspecies.)

Geographical distribution.—Pyrenees, Alps (except extreme south-western portion: Basses-Alpes and Var), Apennines and Tirol.

Diagnosis.—Size rather large (head and body about 130 mm. in adults, hind foot, 20–22 mm., condylobasal length of skull, 28–30·4 mm.); tail about half as long as head and body; colour of upper parts in adults grey, strongly suffused with bister, but never much clouded with black; tail whitish, usually tinged with brown above, though never sharply bicolor throughout; general characters of skull as in the sub-genus; mesopterygoid fossa narrow, its width anteriorly never more than equal to distance between edge of fossa and alveolus of m^3, its outer borders vertical; posterior border of palate with median ridge usually flattened and ill-defined, its width at least equal to that of lateral pit.

External characters.—General appearance more murine than in the other European species of *Microtus*, owing to the long tail and large ears rather than to any special modification in form of body. Head relatively longer and more pointed than

in *M. agrestis*. Ear rather large, appearing distinctly above surrounding fur and extending nearly or quite to eye when laid forward; meatal lobe well developed, high, its margin evenly rounded. Muzzle essentially as in *M. agrestis*. Feet as in *M. agrestis*, but posterior plantar tubercle larger than those at base of digits. Tail about half as long as head and body, the hairs not entirely concealing the annulations, of which there are about eighteen to the centimeter at middle; pencil inconspicuous. Fur full, soft and loose. Mammæ: $p\ 2-2$, $i\ 2-2=8$.

Colour.—Upper parts smoke-grey, strongly washed with bister on back, and usually tinged with pale buff along sides; underparts dull white, irregularly clouded by the slaty under-colour; feet and tail whitish, the tail usually (in about two-thirds of the skins examined) tinged with brown above though never sharply bicolor.

Skull.—The skull is larger than that of *Microtus agrestis agrestis*, its general form broader and more depressed, the dorsal surface much less marked by ridges for muscle attachment, and the auditory bullæ more developed. Dorsal profile nearly flat from lachrymal region to lambda, or with a faint concavity in interorbital region and equally slight convexity over middle of braincase*; nasals sloping forward at an evident though slight angle (about 15°). Occiput sufficiently oblique for the condyles to be just visible when skull is viewed from above. Ventral profile with no special peculiarities; contrast between occipital depth and that of rostrum evident but less pronounced than in the European members of the sub-genus *Microtus*. Brain-case large relatively to general size of skull, its outline when viewed from above broadly ovate, wider anteriorly than posteriorly; postorbital processes small and inconspicuous, producing no very noticeable break in contour of brain-case; ridges along outer portion of parietals scarcely visible except in extreme old age, and never becoming conspicuous; lambdal crest represented by extreme outer portions only, these much less developed than in *M. agrestis*; interparietal relatively smaller than in *M. agrestis*, its area scarcely more than half that of parietal, its form not peculiar (antero-posterior diameter, exclusive of median projection, slightly less than half transverse diameter). Depth of occiput when viewed from behind barely more than half height, the

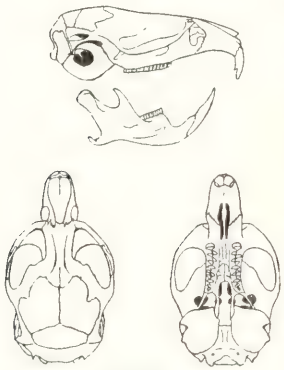

FIG. 148.
Microtus nivalis. Nat. size.

* Somewhat exaggerated in fig. 148.

brain-case scarcely rising above occipital level; paroccipital processes rather short, their tips projecting only a little beyond level of lower lip of foramen magnum, the ridges extending upward from their bases evident though not very high. Floor of brain-case nearly smooth, the median ridge of basioccipital slightly developed; width of basioccipital along anterior suture contained about $2\frac{1}{2}$ times in median length; auditory bullæ large but somewhat flattened, otherwise without special peculiarities. Interorbital region rather wide (usually wider than rostrum) and short, the upper surface flattened and with low, inconspicuous temporal ridges which may come together very late in life, but which are too low to form an evident median ridge; interlachrymal region always essentially smooth. Zygomata not very widely or abruptly spreading, the contrast between zygomatic breadth and breadth of brain-case much less than in *Microtus agrestis*; median expansion evident but not very wide; anteorbital foramen rather wide and low, its form diagnostic as compared with that of *M. agrestis*. Rostrum slender, relatively smaller than in *M. agrestis* and with less contrast in depth between proximal and distal regions, the least depth behind nasals distinctly greater than width in same region; nasals less narrowed posteriorly than in *M. agrestis*, their hinder border usually truncate and scarcely extending behind level of anterior border of zygomatic root; nasal branches of premaxillaries usually extending about to level of middle of zygomatic root; incisive foramina about as in *M. agrestis*, but extending backward scarcely to level of m^1. Palate narrow, its structure normal, but all the surface sculpture lacking in relief, the sloping portion of median ridge wider than small, shallow lateral pit; mesopterygoid space nearly parallel sided, its anterior border rounded, its width in front scarcely equal to distance from margin of fossa to alveolus of m^3; plates forming outer border of space nearly vertical; hamulars straight; ectopterygoid plate well developed, the ectopterygoid pit large and deep, though slightly more encroached on than is the case in *M. agrestis*. Mandible essentially as in *M. agrestis* but more slender, coronoid process lower, and angular process longer.

Teeth.—Incisors essentially as in *Microtus agrestis* but relatively a little less robust; upper teeth projecting slightly forward, so that their front surface is just visible when skull is viewed from above. Molars* relatively smaller than in the European species of true *Microtus*, but the general character of their enamel folding without special peculiarity other than a slight tendency toward roundness in outline of closed triangles of maxillary teeth, particularly the triangles of inner side. The pattern in m^1, m^2 and m_2 shows no peculiarities worthy of special note; m^2 without postero-internal loop. Third lower molar with re-entrant angles on outer side tending to be deeper than usual,

* Fig. 149, p. 718.

so that the second loop is often nearly or completely divided into two closed triangles. Third upper molar with anterior loop and three closed triangles of the usual form, but posterior loop short, simple and without trace of re-entrant angle on inner side (though in some instances a slight widening of the extreme tip causes a certain degree of concaveness), its form much like that assumed by extreme terminal portion of loop in *M. agrestis* when second inner triangle has been cut off: the tooth never has more than three well developed salient and two re-entrant angles on each side. First lower molar essentially as in *Microtus ratticeps*, the outer side with three, the inner side with four re-entrant angles, the anterior loop short, simple, without trace of re-entrant angles, its general outline crescentic (or when more elongate almost arrow-head shaped) when outer basal portion is well developed, or unsymmetrical when this is short or obsolete; first inner triangle rarely communicating with anterior loop; outer side normally with four salient and three re-entrant angles, inner side with five salient and four re-entrant angles.

Remarks.—*Microtus nivalis* is a strictly alpine animal, never inhabiting plains or true lowlands and only descending into valleys when special local conditions, such as damp, shaded cliffs or cool talus-slopes,* furnish it with the low summer temperature which it requires. Two local forms are distinguishable, one confined to the Pyrenees, the other to the region of the Alps.

Microtus nivalis nivalis Martins.

1842. *Arvicola nivalis* Martins, Revue Zoologique, p. 331 (Faulhorn, Bern, Switzerland).

1843. *Hypudaeus alpinus* Wagner, Schreber's Säugthiere, Suppl., III, p. 576 (Andermatt, Uri, Switzerland).

1845. *Arvicola nivicola* Schinz, Synops. Mamm., II, p. 236 (Highest Swiss Alps; probably near Andermatt).

1853. *Hypudaeus petrophilus* Wagner, Münch. Gelehrt. Anzeigen, No. 38, p. 307, March 28, 1853 (Oberstdorf, near Sonthofen, Allgäu, Bavaria, Germany).

1857. *Arvicola nivalis* Blasius, Säugethiere Deutschlands, p. 359.

1884. [*Microtus*] *nivalis* Lataste, Actes Soc. Linn., Bordeaux, XXXVIII, p. 23 (p. 15 of reprint).

1908. *Microtus nivalis nivalis* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 99, January, 1908.

1910. *Microtus* (*Chionomys*) *nivalis* Trouessart, Faune Mamm. d'Europe, p. 183.

Type locality.—Faulhorn, Bern, Switzerland.

Geographical distribution.—Alps (except south-eastern portion), Tirol and northern Apennines.

Diagnosis.—Anterior loop of first lower molar tending to assume an arrow-head-like outline, owing partly to the general

* For a study of the local conditions in a typical talus-slope see Miller, Science, N.S., VIII, pp. 615–618, November 4, 1898.

narrowness of the loop, but more especially to the form of the postero-external salient angle, which is usually narrow and sharply pointed, and rarely, if ever, except in immature individuals, obsolete.

Measurements.—External measurements of adult male from Chamonix, Haute-Savoie, France: head and body, 139; tail, 71; hind foot, 20. Two adult males from the Furka Pass, Switzerland: head and body, 127 and 133; tail, 63 and 68; hind foot, 19·6 and 19. Two adult females from the same locality: head and body, 126 and 131; tail, 72 and 69; hind foot, 20 and 20; ear, 15. Adult male from Säntis, Appenzell, Switzerland: head and body, 126; tail, 70; hind foot, 20; ear, 15. Adult male from Valasco, Valle del Gesso, Cuneo, Italy: head and body, 132; tail, 74; hind foot, 21; ear, 17. Adult female from Monte Cimone, Modena, Italy: head and body, 120; tail, 63; hind foot, 20. For cranial measurements see Table, p. 720.

Specimens examined.—Sixty-two, from the following localities:—

France: Chamonix, Haute-Savoie, 2 (U.S.N.M.).

Switzerland: Sangloz, Vaud, 2 (U.S.N.M.); Eusannaz, Vaud, 2 (U.S.N.M.); Zermatt, Valais, 3 (U.S.N.M.); Mürren, Berne, 2; Meiringen, Berne, 2; Furka Pass, Uri, 11 (B.M. and U.S.N.M.); St. Gothard, Uri, 4; Andermatt, Uri, 5 (U.S.N.M.); Göschenen, Uri, 6 (U.S.N.M. and Mottaz); Säntis, Appenzell, 12 (U.S.N.M.); Meglis Alp, Appenzell, 2 (U.S.N.M.); Hochmättli, Murgsee region, St. Gallen, 2 (U.S.N.M.); Cämpfer, Grisons, 1 (Rothschild); no exact locality, 2.

Germany: Oberstdorf, near Sonthofen, Allgäu, Bavaria, 2.

Italy: Valasco, Valle del Gesso, Cuneo, 1 (Genoa); Monte Cimone, Modena, 1.

2.	Mürren, Berne, Switzerland.	W. Gurtner (c & p).	92. 10. 5. 10–11.
2.	Meiringen, Berne.	Tomes Collection.	7. 1. 1. 143–144.
7 ♂, ♀.	Furka Pass, Uri. (*E. H. Zollikofer.*)	O. Thomas (p).	2. 8. 4. 43–47. 4. 4. 5. 54–56.
1.	St. Gothard, Uri.	Baron E. de Sélys-Longchamps (p).	45. 7. 5. 3.
2.	St. Gothard, Uri.	Purchased (Brandt).	45. 11. 1. 6-7.
1.	St. Gothard, Uri.	Stockholm Museum (e).	46. 6. 2. 67.
♂.	Switzerland. (*Möschler.*)	E. R. Alston (p).	79. 9. 25. 50.
1.	Switzerland.	Purchased (Parreys).	46. 6. 15. 58.
♀ al.	Monte Cimone, Modena, Italy. (*Dr. Major.*)	Modena Museum (p).	3. 2. 22. 1.

Microtus nivalis aquitanius Miller.

1908. *Microtus nivalis aquitanius* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 99, January, 1908. Type in British Museum.

1910. *Microtus* (*Chionomys*) *nivalis aquitanius* Trouessart, Faune Mamm. d'Europe, p. 184.

Type locality.—Near l'Hospitalet, Ariège, France. Altitude about 4800 feet.

Geographical distribution.—Pyrenees; at present known from the French side only.

Diagnosis.—Similar to *Microtus nivalis nivalis*, but anterior loop of first lower molar broadly crescentic in outline, the postero-external salient angle broad and rounded, occasionally obsolete.

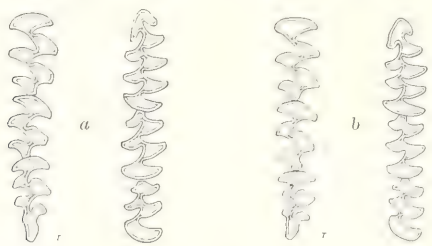

FIG. 149.
Enamel pattern of *Microtus nivalis nivalis* (*a*) and *M. nivalis aquitanius* (*b*). × 5.

Measurements.—Type (young-adult male) : head and body, 111 ; tail, 59 ; hind foot, 21 ; ear, 16. Two adult males from the type locality : head and body, 124 and 124 ; tail, 61 and 64 ; hind foot, 20·4 and 21 ; ear, 17·8 and 19·4. Adult male from Pic-du-Midi, Hautes-Pyrénées : head and body, 129 ; tail, 71 ; hind foot, 21 ; ear, 17. For cranial measurements see Table, p. 721.

Specimens examined.—Fourteen, from the following localities on the French side of the Pyrenees : Porté, Pyrénées-Orientales, 2 ; l'Hospitalet, Ariège, 5 ; Barèges, Hautes-Pyrénées, 1 ; Pic-du-Midi, Hautes-Pyrénées, 6.

2 ♀.	Porté, Pyrénées - Orientales, France.	G. S. Miller (c). 8. 8. 4. 240–241.
3 ♂.	L'Hospitalet, Ariège.	G. S. Miller (c). 8. 8. 4. 237–239. (8. 8. 4. 238. *Type* of subspecies.)
3 ♂, 3 ♀.	Pic-du-Midi, Hautes-Pyrénées. (*A. Robert.*)	O. Thomas (p). 8. 9. 1. 64–69.

MICROTUS LEBRUNII Crespon.

(Synonymy under subspecies.)

Geographical distribution.—Central and south-eastern France from Puy-de-Dôme to the Departments of Gard, Var, and Basses-Alpes.

Diagnosis.—Like *Microtus nivalis*, but smaller (hind foot in adults less than 20 mm. ; condylobasal length of skull less than 28 mm.), and paler, the tail always pure white throughout, and the back a light grey without conspicuous brownish suffusion.

Skull.—Except for its smaller size, the skull does not differ tangibly from that of *M. nivalis*.

Teeth.—As compared with those of *M. nivalis* of the same age, the teeth differ in their slightly smaller size, but I can find

no constant character in the enamel pattern by which they may be distinguished. In the specimens examined the terminal loop of m^3 is invariably short and broad, not showing any tendency to the elongation occasionally occurring in *M. nivalis*.

Remarks.—*Microtus lebrunii* is represented by two geographic races, one of which is remarkable, in the sub-genus *Chionomys*, for its occurrence at a distance from mountains and in a region of unusually high summer temperature.

MICROTUS LEBRUNII LEBRUNII Crespon.

1844. *A[rvicola] lebrunii* Crespon, Faune Méridionale, I, p. 77.
1857. *Arvicola nivalis* b. *Arvicola leucurus* Blasius, Säugethiere Deutschlands, p. 359 (part).
1908. *Microtus lebrunii lebrunii* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 101, January, 1908.
1910. *Microtus* (*Chionomys*) *lebruni* Trouessart, Faune Mamm. d'Europe, p. 184.

Type locality.—Neighbourhood of Nîmes, Gard, France. Altitude, 180 m.

Geographical distribution.—Known with certainty from the type locality only, but probably extending through the Cévennes and the mountains of Auvergne.

Diagnosis.—Back clear, very pale smoke-grey, without evident wash of wood-brown; skull with auditory bullæ small and flattened.

Colour.—Upper parts a very pale smoke-grey with a faint bluish tinge, particularly on neck and between ears, the back faintly "lined" with black, the sides and rump nearly clear; underparts buffy white, not sharply defined, the slate-black under colour appearing irregularly at surface and producing a bluish tinge; sides of muzzle dull white; feet and tail white throughout.

Skull.—Auditory bullæ decidedly reduced in size as compared with those of *M. nivalis*, so that the lower edge of bulla scarcely extends beyond line of cutting edge of molars.

Measurements.—Three adult males from the type locality: head and body, 117, 121 and 122; tail, 56, 55 and 66; hind foot, 18·6, 19·6 and 18·8; ear, 13, 14·2 and 14. For cranial measurements see Table, p. 721.

Specimens examined.—Six, all from the neighbourhood of Nîmes (B.M., Mottaz and Nîmes); no exact locality, 2.

Remarks.—This animal presents the anomaly of a member of the *nivalis* group completely adapted to life in the hot dry plains of south-central France, a region where its presence can in no way be explained as due to special local conditions. A mounted specimen in the Paris Museum collected in Auvergne (probably near Clermont-Ferrand) by Lecoq, and presented in 1854, is

Locality.	Number	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Occipital breadth.	Occipital depth (median).	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
M. nivalis nivalis.													
France: Chamonix, Haute-Savoie	124482	♂	29·4	17·2	4·0	—	7·2	8·2	9·0	18·8	6·8	6·6	Ridges 1·4 mm. apart.
Switzerland: Sangloz	104527	♀	28·6	16·0	4·0	12·8	6·8	7·6	8·6	18·2	6·8	6·8	,, 1 mm. ,,
Zermatt, Valais	124517	♂	29·0	16·4	4·0	14·0	7·4	8·0	9·0	18·6	6·8	6·8	,, 1·4 mm. ,,
,, ,,	124518	♀	27·6	15·8	4·0	13·2	7·0	7·4	9·4	17·8	6·8	6·6	,, 1·6 mm. ,,
Furka Pass	4. 4. 5. 54	♂	28·2	16·0	4·0	13·0	7·0	7·8	8·4	17·6	6·8	6·8	,, 1 mm. ,,
,, ,,	4. 4. 5. 45	♂	29·8	17·0	4·2	13·8	7·0	7·8	9·2	18·0	7·0	6·8	,, 1·6 mm. ,,
,, ,,	4. 4. 5. 55	♂	28·0	15·8	4·2	13·0	7·2	—	8·6	18·0	7·0	7·0	,, 2 mm. ,,
,, ,,	4. 4. 5. 56	♂	29·0	16·4	4·2	13·2	7·0	7·6	8·8	18·0	6·8	7·0	,, 1 mm. ,,
,, ,,	2. 8. 4. 44		30·4	17·0	4·0	13·6	7·8	8·0	9·4	18·4	7·0	7·0	,, 0·8 mm. ,,
,, ,,	2. 8. 4. 46	♂	28·6	17±	4·6	13·4	7·0	7·6	8·6	18·0	6·8	7·0	,, 0·8 mm. ,,
,, ,,	86190	♂	29·2	16·4	4·2	13·2	6·8	8·0	9·0	18·4	6·6	6·6	,, 1·6 mm. ,,
,, ,,	115262	♂	28·8	17·2	4·6	13·6	7·2	7·8	9·0	18·2	6·8	6·8	,, 1·8 mm. ,,
,, ,,	115263	♀	29·0	16·2	4·0	13	6·7	8·0	8·6	18·2	7·0	6·8	,, 1·8 mm. ,,
Göschenen, Uri	1665 Mottaz	♂	29·6	16·8	4·2	—	7·2	8·4	9·6	18·2	6·8	6·8	
,, ,,	1685 ,,	♂	29·0	16·0	4·0	13·4	6·8	7·8	8·8	17·8	6·8	6·6	
,, ,,	1663 ,,	♀	28·6	16·6	4·0	13·0	7·0	7·4	9·0	18·0	6·8	6·8	
,, ,,	1673 ,,	♀	28·4	16·8	4·0	—	7·2	7·8	9·2	18·0	6·8	6·6	
Andermatt ,,	85738	♀	28·4	16·2	4·0	13·0	7·0	7·6	8·8	18·4	7·0	6·8	,, 1 mm. ,,
Säntis, Appenzell	115264	♂	29·4	16·8	4·2	13·4	7·4	8·2	8·8	18·2	6·8	6·8	,, 1·4 mm. ,,
Meglis Alp, Appenzell	145181	♀	29·0	16·8	4·2	13·6	7·2	8·0	8·8	18·8	6·8	6·6	,, 1·6 mm. ,,
Germany: Oberstdorf, Allgäu	8. 11. 30. 15	♀	29·2	17·0	4·2	13·0	7·6	8·0	9·0	18·8	7·0	6·8	
Italy: Valasco, Cuneo	Genoa	♂	32·0	18·4	4·6	14·6	7·2	8·6	10·0	20·0	7·0	6·8	Young adult.
Mt. Cimone, Modena	3. 2. 22. 1	♀	29·8	17·2	4·4	13·0	7·4	8·4	9·0	19·2	7·2	7·2	Ridges 2 mm. apart.

M. nivalis aquitanius.												
France: l'Hospitalet, Ariège . .	8. 8. 4. 237	♂	29·8	17·4	4·2	14·0 7·8	8·6	9·2	18·6	7·0	7·0	Ridges 1·4 mm. apart.
,, ,, . .	8. 8. 4. 238	♂	28·0	16·8	4·6	13·0 7·4	8·0	8·4	17·8	6·8	6·8	,, 2·2 mm. ,,
Pic-du-Midi . . .	2161 Lataste		29·0	17·0	4·6	14·0 7·2	8·4	8·8	18·6	7·4	7·2	,, 1·8 mm. ,,
,, ,, . . .	2300 ,,		28·0	16·0	4·4	12·8 7·8	8·0	8·4	17·0	7·0	6·8	,, 1·8 mm. ,,
,, ,, . . .	8. 9. 1. 64	♂	29·4	16·8	4·4	13·0 7·2	8·2	9·0	19·0	7·0	6·6	
M. lebrunii lebrunii.												
France: Nîmes, Gard . . .	8. 8. 10. 101	♂	27·2	15·8	4·6	12·4 7·0	7·6	8·2	17·0	6·6	6·2	,, 2·4 mm. ,,
,, ,, . . .	8. 8. 10. 102	♂	—	16·0	4·6	13·2 7·2±	—	—	18·0	7·2	7·0	,, 2·0 mm. ,,
,, ,, . . .	8. 8. 10. 103	♂	27·4±	15±	4·6	— 7·4	8·0	8·2	18·0	6·4	6·2	,, 2·6 mm. ,,
,, ,, . . .	Ca 46 Mottaz		27·2	16·0	4·4	12·4 7·2	8·0	8·0	17·2	6·8	6·4	
M. lebrunii leucurus.												
France: Barcelonnette, Basses-Alpes	8. 8. 10. 105	♀	—	16±	4·6	— —	8·0	8·8	18·0	7·0	6·8	,, 1·6 mm. ,,
,, ,,	Ca 122 Mottaz		27·4	16·2	4·6	13·2 7·2	7·4	8·2	17·4	6·6	6·6	
,, ,,	Mottaz	♂	28·4	16·4	4·2	13·6 7·4	7·8	8·8	18·4	6·6	6·4	
Barcelonnette? ("Provence")	85547		27·4	15·0	4·0	13·0 7·2	7·4	8·8	17·8	6·8	6·4	,, 1·4 mm. ,,
M. ulpius.												
Austria-Hungary: Hatszeg, Hunyad .	3. 11. 8. 38	♀	28·0	16·0	4·2	13·4 7·0	7·2	8·6	17·8	7·2	6·8	,, 1·8 mm. ,,
,, ,, .	3. 11. 8. 39	♀	29·4	17·2	4·0	13·6 7·2	7·6	8·8	19·0	7·2	7·0	,, 1 mm. ,,
,, ,, .	3. 2. 2. 47	♀	28·2	17·0	4·6	13·4 7·4	7·6	8·6	18·0	7·0	7·0	,, 2 mm. ,,
,, ,, .	3. 2. 2. 48*	♀	30·4	18·0	4·4	15± 7·4±	8·0	9·2	19·4	7·2	7·0	,, 1 mm. ,,
,, ,, .	3. 2. 2. 49	♀	29·4	18·0	4·4	14·0 7·2	8·2	9·0	19·6	7·2	7·2	,, 0·8 mm. ,,
,, ,, .	3. 11. 8. 41	♀	28·6	16·6±	4·2	13·4 7·2	8·0	8·4	18·0	7·0	7·0	,, 0·6 mm. ,,

* Type.

probably referable to *Microtus lebrunii lebrunii*, though in its present faded and dust-stained condition exact identification is impossible. The skull is so imperfect that it serves only to show that the animal was not adult.

3 ♂.	Nîmes, Gard, France. (*C. Mottaz.*)	O. Thomas (P). (*Topotypes.*)	8. 8. 10. 101–103.
2.	S. France.	Tomes Collection.	7. 1. 1. 146–147.

Microtus lebrunii leucurus Gerbe.

1852. *Arvicola leucurus* Gerbe, Revue Zoologique, 2nd ser., iv, p. 260, June, 1852.
1857. *Arvicola nivalis* b. *Arvicola leucurus* Blasius, Säugethiere Deutschlands, p. 359 (part).
1908. *Microtus lebrunii leucurus* Miller, Ann. and Mag. Nat. Hist., 8th ser., i, p. 102, January, 1908.
1910. *Microtus* (*Chionomys*) *lebruni leucurus* Trouessart, Faune Mamm. d'Europe, p. 184.

Type locality.—Barcelonnette, Basses-Alpes, France. Altitude about 1300 mm.

Geographical distribution.—South-western Alps (Departments of Basses-Alpes and Var).

Diagnosis.—Upper parts pale smoke-grey, slightly but evidently washed with wood-brown; skull with auditory bullæ large and well inflated, essentially as in *M. nivalis*.

Colour.—The colour resembles that of *M. lebrunii lebrunii*, except that the back is sufficiently suffused with buffy or pale wood-brown to destroy the clear grey, almost hoary appearance characteristic of the typical, lowland race. This suffusion is usually more noticeable on rump than on sides, so much so that in one specimen (No. 7. 1. 1. 145, probably a paratype) the rump is a clear dull buff.

Skull.—The skull is distinguishable from that of *M. lebrunii lebrunii* by its large, strongly inflated, normally developed auditory bullæ. As in *M. nivalis* the lower edge of the bulla extends decidedly beyond line of cutting edge of molars.

Measurements.—Adult female from St. Paul, near Barcelonnette, Basses-Alpes, France: head and body, 120; tail, 68; hind foot, 19; ear, 14·8. For cranial measurements see Table, p. 721.

Specimens examined.—Twelve, all from the vicinity of Barcelonnette (B.M. and Mottaz); also several old specimens without definite locality, probably referable to the same race (B.M. and U.S.N.M.).

♂, ♀.	Barcelonnette, Basses-Alpes, France. (*C. Mottaz.*)	O. Thomas (P.) (*Topotypes.*)	8. 8. 10. 104–105
3.	Basses-Alpes.	Purchased (Parzudaki).	52. 5. 27. 47–49.
1.	S. France.	Tomes Collection.	7. 1. 1. 145.

MICROTUS ULPIUS Miller.

1908. *Microtus ulpius* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 100, January, 1908. Type in British Museum.
1910. *Microtus* (*Chionomys*) *ulpius* Trouessart, Faune Mamm. d'Europe, p. 184.

Type locality.—Hatszeg, Hunyad, Austria-Hungary. Altitude, 2000 feet.

Geographical distribution.—Known only from the vicinity of the type locality, but probably occurring throughout the Transylvanian Alps and perhaps in the true Carpathians also.

Diagnosis.—Similar to *Microtus nivalis*, but colour darker and tail usually brown above (often distinctly bicolor throughout); posterior border of palate with median ridge sharply defined, its width less than that of deep lateral pit.

Colour.—Though in general resembling that of *Microtus nivalis* the colour is distinctly darker, the back strongly tinged with wood-brown and conspicuously clouded with black; tail usually bicolor, often sharply and conspicuously so throughout.

Skull and teeth.—Except for the narrow, sharply defined median ridge and deep lateral pits the palate is as in *M. nivalis*. The other parts of the skull show no peculiarities. Teeth as in *Microtus nivalis*, the anterior loop of m_1 usually similar to that of *M. n. aquitanius*.

Measurements.—External measurements of type (adult female): head and body, 131; tail, 58; hind foot, 20; ear, 17. A second adult female from the type locality: head and body, 124; tail, 68; hind foot, 22; ear, 17. For cranial measurements see Table, p. 721.

Specimens examined.—Eighteen, all from the neighbourhood of Hatszeg.

6 ♂, 7 ♀. Hatszeg, Hunyad, Transylvania, Austria-Hungary. C. G. Danford (c). 3. 2. 2. 45–49. 3. 11. 8. 35–42. (3. 2. 2. 48. *Type* of species.)

GENUS ARVICOLA Lacépède.

1799. *Arvicola* Lacépède, Tableau des divisions, sous divisions, ordres et genres des mammifères, p. 10 (*amphibius*).
1836. *Hemiotomys* de Sélys-Longchamps, Essai monographique sur les Campagnols des environs de Liége, p. 7 (sub-genus) part.
1857. *Paludicola* Blasius, Säugethiere Deutschlands, p. 333 (sub-genus) part. Not *Paludicola* Wagler, 1830.
1867. *Ochetomys*, Fitzinger, Sitzungsb. Math. Naturwiss. Cl. K. Akad. Wissensch., Wien, LVI, p. 47 (based primarily on the water-rats of Europe).
1867. *Praticola* Fatio, Les Campagnols du Bassin du Léman, p. 36 (sub-genus) part. Not *Praticola* Swainson, 1837.
1883. *Arvicola* Lataste, Le Naturaliste, II, p. 349 (sub-genus).

1896. *Arvicola* Miller, North Amer. Fauna, no. 12, p. 66, July 23, 1896 (sub-genus).

1908. *Arvicola* Miller, Ann. and Mag. Nat. Hist. 8th ser., I., p. 195, February, 1908 (genus).

Type species.—*Mus amphibius* Linnæus.

Geographical distribution.—Palæarctic region from Great Britain eastward into Asia, and from the Mediterranean coast north to northern Scotland and the shores of the Arctic Ocean.

Characters.—Like *Microtus*, but plantar tubercles only five (a very rudimentary sixth rarely present); third upper molar as in *Chionomys;* external form modified for aquatic or subterranean life.

Remarks.—Though not sharply differentiated from *Microtus*, this group is so natural that it may conveniently be treated as a genus. Its range does not extend beyond the Palæarctic region. About fifteen forms are known, eleven of which occur in western Europe. Some of these are strictly aquatic in their mode of life, others fossorial, while in two (*A. terrestris* and *A. scherman scherman*) the habits appear to vary locally or with season.

KEY TO THE EUROPEAN FORMS OF *ARVICOLA*.

Size large, hind foot more than 30 mm., condylobasal length of fully adult skulls usually more than 40 mm.; skull not fossorial in form, the rostrum and occiput tending to be squarely truncate, the upper incisors slightly projecting; roots of m_1 and m_2 forming evident protuberances on lower surface of mandible in old individuals; habits strictly aquatic (*amphibius* group).

Nasals at widest region conspicuously narrower than rostrum (Great Britain) ..... *A. amphibius*, p. 725.

Condylobasal length of skull usually 42 to 44 mm.; colour dark, but melanism infrequent (England) ..... *A. a. amphibius*, p. 730.

Condylobasal length of skull usually 40 to 42 mm.; colour very dark, melanism frequent (Scotland) ..... *A. a. reta*, p. 732.

Nasals at widest region nearly as wide as rostrum (Spain and southern France) ..... *A. sapidus*, p. 732.

General colour rather light, the sides and face clear yellowish brown (Spain, except Asturias; lowlands of southern France) ..... *A. s. sapidus*, p. 733.

General colour dark (as in *amphibius*), the sides and face strongly "lined" with black (Pyrenees and Asturias) ..... *A. s. tenebricus*, p. 735.

Size medium or small, hind foot usually less than 30 mm., condylobasal length of fully adult skulls usually less than 40 mm.; skull slightly or conspicuously fossorial in form, the rostrum and occiput tending to be obliquely truncate, the upper incisors noticeably projecting; roots of m_1 and m_2 never forming protuberances on lower surface of mandible; habits aquatic or terrestrial (*terrestris* group).

Interparietal tending to be somewhat ligulate in outline; skull representing the extreme of fossorial adaptation ..... *A. scherman*, p. 744.
Colour dark brown, the tail usually blackish throughout; habits both aquatic and fossorial (Northern central Europe from southern Germany to the Baltic and from Belgium eastward) ..... *A. s. scherman*, p, 745.
Colour light yellowish brown, the tail usually bicolor or buffy; habits mole-like, strictly fossorial.
Anterior loop of m_1 short and wide; auditory bullæ usually somewhat flattened (Alps and their immediate neighbourhood)..... *A. s. exitus*, p. 746.
Anterior loop of m_1 long and narrow; auditory bullæ evenly inflated (Pyrenees and their immediate neighbourhood) ..... *A. s. monticola*, p. 749.
Interparietal tending to be quadrate in outline; skull less extremely fossorial in form.
Molars relatively weak; underparts with conspicuous rusty wash which usually spreads noticeably on sides of head (Norway and Sweden) ..... *A. terrestris*, p. 738.
Molars relatively heavy; underparts with at most an ochraceous wash which rarely spreads noticeably on sides of head.
General colour strongly yellowish, the back with little if any clouding of black (Central Italy) ..... *A. musignani*, p. 744.
General colour dark brown, the back with noticeable clouding of black.
Underparts slaty, washed with yellowish brown (Italian Switzerland and northern Italy)..... *A. italicus*, p. 740.
Underparts slaty, washed with whitish (Bosnia and Roumania) ..... *A. illyricus*, p. 741.

ARVICOLA AMPHIBIUS Linnæus.

(Synonymy under subspecies.)

Geographical distribution.—Great Britain.

Diagnosis.—Size large (head and body about 200 mm., tail about 110 mm., hind foot usually 30 to 34 mm., condylobasal length of fully adult skulls, 40 to 44·6 mm.); tail somewhat more than half as long as head and body; colour above dark brown, blackening along back, the sides not decidedly yellowish, the cheeks not contrasted with surrounding parts; skull not fossorial in form, the rostrum and occiput tending to be squarely truncate (vertically), the upper incisors not unusually projecting; nasals at widest region conspicuously narrower than rostrum; roots of m_1 and m_2 forming evident protuberances on lower surface of mandible in old individuals; habits strictly aquatic, never mole-like.

External characters.—General form heavier and more robust than in the house rat, the tail relatively shorter and head

noticeably more rounded. Upper incisors slightly projecting when mouth is closed. Ear well developed but low, scarcely appearing above surface of fur, and extending barely more than half-way to eye when laid forward, its outline sub-circular; meatal valve well developed, bluntly triangular, naked; both surfaces of ear thinly clothed with rather long hairs. Eye small, its position half-way between muzzle and ear. Muzzle pad small, naked, with no special peculiarities, its lower border continuous with naked median groove of upper lip. Front foot broad and robust, though not specially enlarged; inner digit rudimentary, smaller than the smallest palmar tubercle, its dorsal surface covered by the closely appressed nail; fifth extending to base of third and fourth, second about to middle of third; third and fourth digits sub-equal and longest, the third slightly exceeding fourth; scales on under surface of digits well defined, three to five in number; claws well developed, slender, slightly curved, their length about equal to that of first phalanx of the respective digits. Palmar tubercles five, all well developed, the two posterior sub-equal and largest, that lying between bases of third and fourth digits smallest; surface of palm between tubercles irregularly wrinkled. Hind foot large, slightly but evidently "feathered" for swimming; first digit extending scarcely to base of second, fifth to just beyond middle of fourth; second, third and fourth digits sub-equal, the third slightly the longest and second slightly the shortest of the three; scales on under surface of digits well defined, three to four number; claws slightly larger and more robust than those of fore foot. Sole naked throughout, except for a sprinkling of fine hairs on posterior third which usually produces a slight pubescence. Plantar tubercles five, well developed, fully as large as pads at base of corresponding claws, occupying about one-half surface of region in which they lie, the skin between them finely granular like that of posterior portion of sole except for a noticeable smooth area indicating position of sixth tubercle; outline of tubercles at base of first and fifth digits sub-circular, that of the others narrowly ovate; postero-internal tubercle slightly larger than any of the others, that at base of first digit smallest. Tail thick at base, tapering noticeably toward tip; when laid forward it extends about to shoulders or slightly beyond; annulations evident, though somewhat irregular, about 15 to the centimeter at middle of tail; hairs numerous, about 4 to 5 mm. in length, nearly concealing the annulations and forming a slight pencil. Mammæ: $p\ 2-2$, $i\ 2-2 = 8$.

Colour.—Upper parts ranging from broccoli-brown to mars-brown or darker, in most specimens rather heavily overlaid with black, though the latter is usually not in excess of the ground-colour; median dorsal region darkest, sides and face lightest, though without noticeable contrast, the sides of body usually somewhat "lined" with black, the sides of head to, and including

ears, usually tinged with ochraceous-buff or light raw-umber, though not sufficiently to produce any marked contrast with surrounding parts; chest and belly a varying mixture of ochraceous-buff and the slate-grey under colour, the two becoming more intimately blended on throat and fading to a light drab grey; feet ranging from hair-brown to ecru-drab, sometimes with a blackish shade; tail blackish throughout, the underside sprinkled with greyish hairs.

Skull.—The skull of *Arvicola amphibius* is large and massive, becoming conspicuously ridged and angular in fully adult

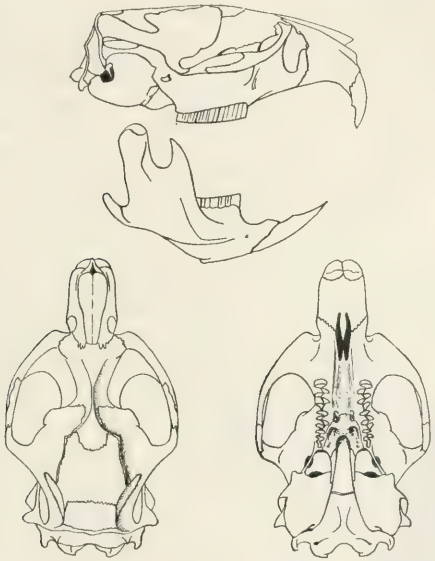

FIG. 150.
Arvicola amphibius. Nat. size.

individuals. In general form and proportions it does not differ notably from the skull of *Microtus agrestis*, except that the brain-case tends to be shorter and wider, the dorsal profile is more evenly convex, without any sudden angular bending down of nasals at interlachrymal region, and the upper incisors project sufficiently forward so that most of their anterior surface is visible when skull is viewed from above. Brain-case somewhat longer than wide, the well-developed postorbital processes squaring its anterior margin and imparting the general outline of a parallelogram; lateral ridges strongly developed in adults and marking off a conspicuous flat median surface widest at

middle, narrowing a little posteriorly to width of interparietal, and more noticeably in front, finally disappearing in region between postorbital processes, where the ridges come together; each ridge with a distinct angle at middle and usually with another less evident angle about half-way between middle and point of juncture; interparietal large, somewhat variable in form, usually ligulate with obliquely truncate outer extremities and slight anterior median projection, but sometimes almost a perfect parallelogram about twice as wide as long; lambdoid crest high and conspicuous at sides, but reduced to a mere angular edge along posterior border of interparietal; truncation of occiput somewhat oblique, slightly more so than in *Microtus agrestis*, the entire occipital condyle usually, though not always, visible when skull is viewed from above; outline of occiput viewed from behind elliptical, flattened at the middle, slightly more than half as high as wide; paroccipital processes large, widely spreading, their extremities not applied to bullæ, their bases continued upward as well-developed ridges joining lambdoid crest near outer extremities of interparietal; foramen magnum higher than wide, its upper border narrowly rounded or forming a distinctly pointed arch; base of brain-case with no special features, the basioccipital with ill-defined median longitudinal ridge, the width of the bone along anterior border contained about 2½ times in its median length; auditory bullæ rather large (about 9 mm. in antero-posterior diameter), but not highly inflated, their ventral border not extending to level of cutting surface of molars. Interorbital region deeply constricted posteriorly, where in old individuals the width is less than half that in lachrymal region; ridges early uniting to form an evident median crest which, however, does not extend forward beyond the deeply constricted region. Zygomata heavy, rather gradually spreading, the greatest zygomatic breath at glenoid level; vertical expansion evident but not abrupt. Rostrum of the same relative size as in *Microtus agrestis*, but somewhat more slender anteriorly; nasals distinctly smaller relatively to rostrum than in *M. agrestis*, their anterior termination falling decidedly short of level of gnathion, their greatest combined breadth noticeably less than that of rostrum in same region; posterior border of nasals squarely truncate at level of about middle of zygomatic root, ascending branches of premaxillaries reaching somewhat further back; incisive foramina relatively shorter than in *Microtus agrestis*, their posterior border falling short of alveolar level by 1 mm. or more, their anterior extremity lying decidedly nearer maxillo-premaxillary suture than to posterior surface of incisor. Bony palate with no special peculiarities as compared with that of *Microtus agrestis*; lateral pits large, but rather shallow; median ridge tending to be low and not sharply defined; mesopterygoid space with anterior border varying from squarely truncate to pointedly arched; posterior half of ptery-

goids noticeably diverging; ectopterygoid pit large and deep, not encroached on by bulla. The mandible does not differ materially from that of *Microtus agrestis* except in its conspicuously greater size, but the articular process is more abruptly bent inward at level of incisor root, and angular process is more widened posteriorly.

Teeth.—Upper incisor with shaft less curved than that of *Microtus agrestis*, its outline from tip to base less nearly a semicircle; root at anterior margin of anteorbital foramen, where it forms a slight though evident swelling. Cross-section of shaft essentially as in *M. agrestis*, but antero-posterior diameter relatively greater, so that inner border is slightly longer than anterior border; distribution of enamel as in the smaller animal. Lower incisor with root extending well into base of articular process, on the outer side of which it usually forms a slight protuberance; cross section, like that of upper tooth, with antero-posterior diameter relatively greater than in *M. agrestis*, the enamel-covered anterior surface thus relatively narrower. Molars large and heavily built; m_3 forming a conspicuous capsule on inner side of incisor, the roots of m_1 and m_2 appearing as distinct protuberances on lower surface of mandible. Enamel pattern well defined, all the elements distinct, the angles sharp and definite. Details of pattern much as in *Microtus nivalis*; m^1 with anterior transverse loop and four alternating, essentially equal closed triangles, each side with three salient and two re-entrant angles; m^2 with anterior transverse loop and three alternating closed triangles, the outer side with three salient and two re-entrant angles, the inner side with two salient and two re-entrant angles; m^3 with anterior transverse loop, a larger inner and smaller outer closed triangle, and a short longitudinal loop, from the antero-external base of which a small third closed triangle is sometimes cut off; each side of tooth with three salient and three re-entrant angles, the last two salients occasionally ill-developed in individuals with reduced terminal loop; m_1 with same elements as in *Microtus nivalis*, but first and second triangles normally opening into each other and into short, subterete anterior loop, of which in some specimens they appear to be mere angular basal appendages; true closed triangles only three, one outer and two inner; outer side of tooth with four salient and three re-entrant angles, inner side with four and a rudimentary fifth (anterior) salient and four re-entrant angles; m_2 with four closed, sub-equal triangles (the antero-internal and

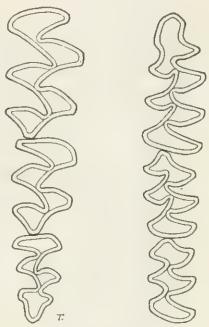

FIG. 151.
Arvicola amphibius.
Enamel pattern. × 5.

antero-external often communicating) and a posterior transverse loop; each side with three salient and three re-entrant angles; m_3 with the same elements as m_2 but smaller and less well-defined, both first and second pair of triangles tending to open into each other, though the two pairs are normally separated.

Remarks.—So far as is at present known *Arvicola amphibius* is confined to Great Britain. Among the continental species it finds its nearest relative in *A. sapidus* of Spain and southern France. Two local races appear to be represented among the specimens examined, though their status is not well defined.

Arvicola amphibius amphibius Linnæus.

1758. [*Mus*] *amphibius* Linnæus, Syst. Nat., I, 10th ed., p. 61 (England: based on the *Mus major aquaticus* of Ray, Quadr., p. 217).

1816. ? *Arvicola aquatica* Leach, Syst. Catal. Spec. Indig. Mamm. and Birds, Brit. Mus., p. 7 (nomen nudum: "Water Campagnol").

1817. *Lemmus aquaticus* F. Cuvier, Dict. des Sci. Nat., VI, p. 306, part (substitute for *amphibius*).

1842. *Arvicola americana* Gray, Ann. and Mag. Nat. Hist., X, p. 226 (half-grown individuals supposed to have been taken in South America). Co-types in British Museum.

1845. ? [*Arvicola amphibius*] sub-var. *nigricans* de Sélys-Longchamps, Atti della sesta Riunione degli Scienziati Italiani, Milano, 1844, p. 322 (nomen nudum).

1857. *Arvicola amphibius* a. Blasius, Säugethiere Deutschlands, p. 344 (part).

1910. *Arvicola amphibius amphibius* Miller, Proc. Biol. Soc. Washington, XXIII, p. 19, March 23, 1910.

1910. *Arvicola amphibius* Trouessart, Faune Mamm. d'Europe, p. ix.

Type locality.—England.

Geographical distribution.—England and southern Scotland; exact northern limits of range not known.

Diagnosis.—Size maximum for the species (hind foot in adults usually 32 to 35 mm., condylobasal length of skull, 42 mm. or more); colour moderately dark, the black rarely in excess of brown on upper parts; melanism infrequent.

Measurements.—Adult male from Diss, Norfolk: head and body, 206; tail, 139; hind foot, 35. Adult female from Cheadle, Staffordshire: head and body, 185; tail, 118; hind foot, 33. Adult female from Shalford, Surrey: head and body, 201; tail, 117; hind foot, 33; ear, 17. Adult male from Garrett Park Lake, Earlsfield, Surrey: head and body, 193; tail, 128; hind foot, 35; ear, 16. Adult male from Minster, I. of Thanet, Kent: head and body, 168; tail, 120; hind foot, 32; ear, 18. Adult from Horsham, Sussex: head and body, 186; tail, 130; hind foot, 33. For cranial measurements see Table, p. 736.

Specimens examined.—Seventy-two, from the following localities:—
Scotland: Blackwood, Lanarkshire, 3 (Edinburgh); Stockbriggs, Lanarkshire, 1; Bargsly, Kirkcudbright, 1; Stirling, 1.

ENGLAND: Alnwick, Northumberland, 1; Wylam, Northumberland, 1; Hull, Yorkshire, 4; Cheadle, Staffordshire, 1; Diss, Norfolk, 1; Ashton, Oundle, Northamptonshire, 2; Waterbeach, Cambridgeshire, 1; Graftonbury, Hereford, 7; Great Grimsby, Lincolnshire, 2; Kingsbury, Middlesex, 1; Hampton, Middlesex, 1; Chertsey, Surrey, 1; Garrett Park Lake, Earlsfield, Surrey, 6; Shalford, Surrey, 9; Surbiton, Surrey, 1; New Forest, Hampshire, 9; Eversley, Hampshire, 3; Aldershot, Hampshire, 3; Clevedon, Somerset, 2; Blandford, Dorsetshire, 2; Cullompton, Devonshire, 2; Northlew, Devonshire, 1; Horsham, Sussex, 1; Minster, I. of Thanet, Kent, 1; Yalding, Kent, 1; no exact locality (supposed to be from South America), 2 (co-types of *americana* Gray).

♀.	Stockbriggs, Lanarkshire, Scotland. (*Taylor.*)	E. R. Alston (P).	79. 9, 25. 46.
♀.	Stirling. (*Brown.*)	E. R. Alston (P).	79. 9. 25. 49.
♂.	Alnwick, Northumberland, England.	W. E. de Winton (C & P).	11. 1. 3. 406.
♂.	Wylam, Northumberland.	W. Burden (P).	11. 1. 3. 294.
2 ♂, 2 ♀.	Hull, Yorkshire. (*Capt. Hume.*)	G. Barrett-Hamilton (P).	11. 1. 2. 54–57.
2 ♂.	Oundle, Northamptonshire. (*Cox.*)	Hon. N. C. Rothschild (P).	6. 8. 18. 1–2.
3 ♂.	Graftonbury, Herefordshire.	W. E. de Winton (C & P).	11. 1. 3. 297–299.
♂, ♀.	Great Grimsby, Lincolnshire.	G. H. Caton Haigh (C & P).	11. 1. 3. 295–296.
♂.	Kingsbury, Middlesex. (*J. E. Harting.*)	E. R. Alston (C & P).	79. 9. 25. 45.
♂.	Hampton, Middlesex. (*W. Dodson.*)	G. Barrett-Hamilton (P).	11. 1. 2. 58.
♀.	Chertsey, Surrey.	Gordon Dagleish (C & P).	4. 10. 13. 1.
♂.	Earlsfield, Surrey.	C. H. B. Grant (C & P).	11. 1. 3. 293.
3 ♂, 6 ♀.	Shalford, Surrey.	W. R. Ogilvie-Grant (C & P).	6. 9. 20. 1–9.
1 (albino)	Surbiton, Surrey.	H. Buller (C & P).	1. 1. 14. 1.
♂, ♀ juv., ♂ al.	Aldershot, Hampshire.	R. I. Pocock (C & P).	88. 7. 14. 1-3.
4 ♂, 5 ♀.	New Forest, Hampshire.	Miller Collection.	7. 7. 7. 2925–2929, 2931–2934.
2 ♂, 1 ♀.	Eversley, Hampshire.	Miller Collection.	7. 7. 7. 2930, 2935–2936.
♂.	Clevedon, Somerset.	R. I. Pocock (C & P).	11. 1. 3. 291.
♂.	Blandford, Dorset.	J. C. Mansel Pleydell (C & P).	11. 1. 3. 292.
♂.	Cullompton, Devonshire.	G. C. Shortridge (C & P).	11. 1. 3. 290.
2.	——	Purchased (Warwick). (*Co-types* of *A. americana* Gray).	42. 4. 12. 6–7.

Arvicola amphibius reta Miller.

1832. *Arvicola ater* Macgillivray, Mem. Wernerian Soc. Nat. Hist. vi, p. 429. Not *Hypudæus terrestris* β *ater* Billberg, 1827.
1910. *Arvicola amphibius reta* Miller, Proc. Biol. Soc. Washington, xxiii, p. 19, March 23, 1910 (substitute for *ater*).
1910. *Arvicola amphibius reta* Trouessart, Faune Mamm. d'Europe, p. x.

Type locality.—Aberdeen, Scotland.

Geographical distribution.—Scotland, except southern portion; limits of distribution not known.

Diagnosis.—Size less than in *A. amphibius amphibius* (hind foot usually 30 to 32 mm., condylobasal length of skull usually less than 42 mm.); normal colour darker than in the typical race, the black usually in excess on upper parts; melanism frequent.

Measurements.—Adult male from Glenfeshire Forest, Inverness: head and body, 190; tail, 125; hind foot, 32; ear, 16. Adult female from Windygates, Fife: head and body, 194·5; tail, 109; hind foot, 30·5; ear, 14·5. For cranial measurements see Table, p. 736.

Specimens examined.—Twelve, from the following localities in Scotland: Elgin, 1; Monar Forest, Ross, 1; Crieff, Perthshire, 1; Glenfeshire Forest, Inverness, 1; Cortachy, Forfar, 3 (B.M. and Wilson); Windygates, Fife, 5 (B.M. and Edinburgh).

♂.	Llanbryde, Elginshire. Scotland.	W. Taylor (c & p).	11. 1. 3. 407.
♂.	Monar Forest, Ross-shire.	Maj.-Gen. C. E. Luard (c & p).	92. 8. 31. 1.
♂.	Kingussie, Inverness-shire.	G. A. Cooper (c. & p).	5. 5. 12. 1.
♀ al.	Crieff, Perthshire.	W. R. Oglivie-Grant (c & p).	88. 5. 30. 2.
♂, ♀.	Windygates, Fife-shire.	N. B. Kinnear (c & p).	6. 11. 18. 5–6.
♂, ♀.	Cortachy, Forfarshire.	E. A. Wilson (c & p).	11. 1. 3. 408–409.

Arvicola sapidus Miller.

(Synonymy under subspecies.)

Geographical distribution.—Iberian Peninsula and southern France east nearly to the Italian border; northern limit of range not known.*

Diagnosis.—Like *Arvicola amphibius* in general size and in form of skull; nasal bones much widened anteriorly, their greatest combined breadth nearly equal to that of rostrum; habits strictly aquatic, never mole-like.

Remarks.—This species appears to be more nearly related to

* An animal of this type occurs at least as far north as Paris (Lataste, Actes Soc. Linn. Bordeaux, xxxviii, p. 37, 1884), but I have had no opportunity to examine specimens.

the large *Arvicola amphibius* of Great Britain than to any of the geographically less distant members of the genus. At present, however, no specimens have been examined from regions in which intergradation with true *Arvicola scherman* might be expected to

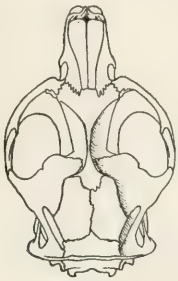

FIG. 152.

Arvicola sapidus. Nat. size.

take place. In the Pyrenees and their immediate neighbourhood a form of *sapidus* occurs in the same region as a strictly terrestrial form of *scherman*, but the two animals are completely segregated by their different modes of life. Two races of *Arvicola sapidus* are now known.

ARVICOLA SAPIDUS SAPIDUS Miller.

1908. *Arvicola sapidus* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 195, February, 1908. Type in British Museum.

1910. *Arvicola sapidus sapidus* Miller, Proc. Biol. Soc. Washington, XXIII, p. 20, March 23, 1910.

1910. *Arvicola sapidus* Trouessart, Faune Mamm. d'Europe, p. x.

Type locality.—Santo Domingo de Silos, Burgos, Spain.

Geographical distribution.—Essentially the entire Iberian Peninsula.

Diagnosis.—General colour not so dark as in *A. amphibius amphibius*, the sides and face a clear yellowish brown without noticeable sprinkling of blackish hairs.

Colour.—Upper parts a yellowish brown varying between the ochraceous-buff and clay-colour of Ridgway, and not infrequently tinged with russet, the back and crown sufficiently sprinkled with black-tipped hairs to produce an evident effect of "lining," the sides and cheeks nearly clear; underparts light ochraceous-buff clouded to a variable degree by the slaty grey under-colour; feet drab-grey; tail brownish, lighter below than above.

Measurements.—External measurements of type (adult female): head and body, 187; tail, 123; hind foot, 34; ear, 18. Average

and extremes of seven adults from the type locality: head and body, 197 (187–205); tail, 126·5 (122–130); hind foot, 34·4 (34–36); ear, 18·4 (18-19). Average and extremes of six adults from Lérida, Spain: head and body, 203·5 (195–210); tail, 122·6 (115–130); hind foot, 33·8 (33–35). Average and extremes of ten adults from Panticosa, Huesca, Spain: head and body, 210 (200–218); tail, 125·6 (119–133); hind foot, 34·2 (33–35). For cranial measurements see Table, p. 737.

Specimens examined.—One hundred and twenty-four, from the following localities:—

Spain: Lérida, 13; Panticosa, Huesca, 32; Jaca, Huesca, 6; Arrechavaleta, Vitoria, 1; Pajáres, Leon, 6; La Coruña, 2 (not typical, approaching *tenebricus*); Silos, Burgos, 20; vicinity of Madrid, 1 (U.S.N.M.); Villalba, Madrid, 1; Barracas, Castellon, 12; Silla, Valencia, 1; Venta del Baul, Granada, 1; Seville, 7; near Tarifa, Cadiz, 1; Audalucia, 5.

France: Forêt de Bouconne, Gers, 1 (not typical); Leguevin, Haute-Garonne, 6 (not typical, approaching *tenebricus*); St. Gilles, Gard, 1 (not typical, approaching *tenebricus*); Valescure, Var, 5 (not typical); Var, no exact locality, 2 (not typical).

Remarks.—Throughout Spain the characters of *Arvicola sapidus sapidus* are very constant; only in the extreme north-west does there appear to be any tendency toward the darker *A. s. tenebricus*. The French specimens from the neighbourhood of Toulouse and from the marshes near the mouth of the Rhone agree with true *sapidus* in the general light yellowish hue of the back and sides, though showing a distinct approach to *tenebricus* in the noticeable sprinkling of black hairs on cheeks.

4 ♂, 3 ♂ juv. 2 ♀, ♀ juv.	Lérida, Spain. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 192–201.
8 ♂, 4 ♀.	Panticosa, Huesca, Spain. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 172–183.
3 ♂, ♀.	Jaca, Huesca. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 184–187.
♂.	Arrechavaleta, Vitoria. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 203.
2 ♀, 2 ♀.	Pajáres, Leon. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 188–191.
2 ♂, 5 ♀.	Silos, Burgos.	G. S. Miller (C). (8. 8. 4. 115. *Type of species.*)	8. 8. 4. 113–119.
♀.	Burgos.	S. & N. Gonzalez (C).	8. 7. 7. 25.
7 ♂, 5 ♀.	Barracas, Castellon. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 160–171.
♂.	Silla, Valencia. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 202.
4 ♀, 2 ♀.	Seville. (*Dr. Ruiz.*)	Lord Lilford (P).	95. 3. 3. 23–28.
Juv. al.	Seville.	Dr. V. L. Seoane (C & P).	94. 3. 19. 3.
♂.	Villalba, Madrid. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 204.
1.	Tarifa, Cadiz.	Col. L. H. Irby (C & P).	94. 4. 27. 1.
3 al, 2.	Andalucia.	Lord Lilford (P).	94. 9. 26. 1–5.
♂.	Forêt de Bouconne, Gers. (*A. Robert.*)	O. Thomas (P).	8. 9. 1. 76.

♂.	Leguevin, Haute-Garonne. (*A. Robert.*)	O. Thomas (P).	8. 9. 1. 77.
♀.	St. Gilles, Gard, France.	G. S. Miller (C).	8. 8. 4. 261.
2 ♂, juv.	Valescure, Var, France.	G. S. Miller (C).	8. 8. 4. 257–260.
♂ 2.	Var.	Purchased (Parzudaki).	52. 5. 27. 44–45.

ARVICOLA SAPIDUS TENEBRICUS Miller.

1884. *Microtus musiniani* Lataste, Actes Soc. Linn. Bordeaux XXXVIII, p. 37 (part). Not *Arvicola musignani* de Sélys-Longchamps.

1908. *Arvicola tenebricus* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 196, February, 1908. Type in British Museum.

1910. *Arvicola sapidus tenebricus* Miller, Proc. Biol. Soc. Washington, XXIII, p. 20, March 23, 1910.

1910. *Arvicola sapidus tenebricus* Trouessart, Faune Mamm. d'Europe, p. x.

Type locality.—Vicinity of Biarritz, Basses-Pyrénées, France.

Geographical distribution.—Pyrenees and Atlantic coast region of south-western France, north to the Garonne; northern limit of range not known; two specimens from La Coruña, Spain, appear to be referable to this race rather than to true *sapidus*.

Diagnosis.—Colour darker than in *A. sapidus sapidus* (essentially like that of *A. amphibius amphibius*), the sides and face conspicuously sprinkled with black-tipped hairs.

Colour.—Upper parts a dull greyish buff, so heavily overlaid with black that the general effect is usually not far from a rather light grizzled bister on back and a greyish wood-brown on sides, the cheeks and sides noticeably sprinkled with black-tipped hairs; underparts slaty grey, washed with light ochraceous-buff on chest and belly; feet hair-brown; tail blackish above, greyish below, seldom distinctly bicolor.

Measurements.—External measurements of type (adult male): head and body, 193; tail, 112; hind foot, 34; ear, 17. Average and extremes of five adults from the type locality: head and body, 197·4 (193–202); tail, 118·5 (112–124); hind foot, 34·4 (33–36); ear, 17·2 (17–18). For cranial measurements see Table, p. 737.

Specimens examined.—Twenty-seven, from the following localities:—
FRANCE:—Porté, Pyrénées-Orientales, 2; l'Hospitalet, Ariège, 2; Luchon, Haute-Garonne, 2; Montréjeau, Haute-Garonne, 5 (U.S.N.M.); Biarritz, Basses-Pyrénées, 7; Cadillac, Gironde, 6 (U.S.N.M.); Barsac, Gironde, 1 (Lataste).
SPAIN:—Coruña, Galicia, 2.

2 ♂.	Porté, Pyrénées-Orientales, France.	G. S. Miller (C).	8. 8. 4. 254–255.
♂.	L'Hospitalet, Ariège.	G. S. Miller (C).	8. 8. 4. 256.
♂ juv.	L'Hospitalet, Ariège. (*A. Robert*).	O. Thomas (P).	8. 9. 1. 71.
5 ♂, 2 ♀.	Biarritz, Basses-Pyrénées.	J. F. Davison (P).	6. 1. 21. 5 6. 6. 6. 4. 10–14. (6. 1. 21. 5. *Type* of subspecies.)
2.	Coruña, Galicia, Spain.	Dr. V. L. Seoane (P).	93. 12. 15. 1. 95. 6. 25. 1.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Occipital breadth.	Occipital depth (median).	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
A. amphibius amphibius.													
England: Hull	11. 1. 2. 55		44·6	25·2	5·0	18·8	11·0	11·8	15·6	29·4	10·0	10·0	Ridges joined.
,,	11. 1. 2. 56		42·4	25·0	5·0	18·6	10·4	11·2	15·2	28·6	9·6	10·0	,, ,,
,,	11. 1. 2. 57		42·0	23·6	5·0	17·8	10·6	10·6	14·6	28·0	9·8	10·0	,, ,,
Ashton, Northampton	6. 8. 18. 1	♂	44·0	26·0	5·4	20·6	11·4	11·6	15·0	29·0	11·2	10·8	,, joined, high.
,, ,,	6. 8. 18. 2	♂	43·0	25·0	5·0	19·0	11·0	12·0	14·8	27·6	10·0	10·8	,, ,,
,, ,,	152934	♂	43·4	—	4·2	20·2	11·4	11·0	15·0	28·0	10·2	10·0	,, ,,
Graftonbury, Hereford	11. 1. 3. 297	♂	42·6	25·4	4·6	19·0	11·6	12·2	14·0	28·6	11·0	11·0	
,, ,,	11. 1. 3. 298	♂	41·0	24·0	4·8	18·2	10·8	10·2	13·8	27·6	11·4	10·8	
,, ,,	11. 1. 3. 299	♂	41·4	24·6	4·6	19·0	11·0	11·0	13·0	27·0	10·8	10·0	
Diss, Norfolk	152932	♂	43·2	—	5·0	18·8	11·2	11·2	14·4	29·0	10·4	10·8	,, joined, moderate.
Hampton	11. 1. 2. 58	♂	44±	25·2	4·2	18·8	—	11·4	15·2	29·0	10·4	11·4	,, joined, high.
Shalford, Surrey	6. 9. 20. 5	♀	42·0	24·8	4·8	19·0	11·0	11·8	13·8	27·0	10·4	11·0	,, joined, low.
,, ,,	6. 9. 20. 8	♀	42·0	24·6	5·0	18·0	11·2	11·0	14·8	28·0	10·0	10·2	,, ,,
,, ,,	- -	♀	43·4	25·6	4·6	19·8	11·0	12·2	15·0	29·8	9·8	10·6	,, joined, high.
Aldershot	88. 7. 14. 1	♂	40·0	24·4	5·2	17·8	10·6	10·6	13·6	24·8	9·0	9·4	,, ,,
A. amphibius reta.													
Scotland: Windygates, Fife	6. 11. 18. 5	♂	41·0	24·6	5·4	18·8	11·0	12·0	14·0	24·4	9·8	9·0	,, nearly joined.
,, ,,	6. 11. 18. 6	♀	39·4	23·6	5·0	17·8	10·4	11·0	13·6	26·4	9·8	9·4	,, ,,
,, ,,	243 Kinnear	♂	40·6	23·6	5·0	17·4	10·4	11·0	14·0	27·0	9·6	9·6	,, joined.

Spain: Lérida	152884	♂	41·8	24·0	4·2	17·2	10·8	11·4	13·8	28·2	10·8	10·4	Ridges joined, low.	
,,	152883	♂	41·4	25·2	4·8	18·0	10·4	11·0	13·0	27·8	10·8	10·4	,,	nearly joined.
Panticosa, Huesca	152908	♂	43·8	25·2	4·4	18·2	10·6	11·8	13·8	29·0	11·2	11·0	,,	joined, low.
,, ,,	8. 2. 9. 174	♂	42·6	25·0	4·6	18·0	10·8	12·0	13·8	28·0	10·6	10·4	,,	,,
,, ,,	8. 2. 9. 175	♂	43·0	25·8	4·4	18·8	10·6	11·6	14·0	29·6	10·6	11·2	,,	joined, high.
,, ,,	8. 2. 9. 176	♂	43·4	24·8	4·0	18·0	10·6	12·0	14·0	29·0	11·0	10·8		
,, ,,	8. 2. 9. 172	♀	42·0	24·4	4·8	18·2	10·6	11·8	14·0	27·6	10·0	10·0	,,	joined, low.
Jaca, Huesca	8. 2. 9. 184	♂	41·4	24·6	4·0	18·0	10·4	11·6	14·0	28·0	10·4	10·6	,,	,,
,, ,,	8. 2. 9. 186	♂	43·0	24·8	4·2	18·2	11·0	11·8	14·0	29·0	10·8	10·4	,,	,,
,, ,,	8. 2. 9. 187	♀	43·6	24·6	4·4	18·0	11·6	11·8	14·4	29·0	11·0	11·0	,,	,,
Arrechavaleta, Vitoria	8. 2. 9. 203	♂	43·0	25·4	4·4	18·0	11·0	11·6±	14·0	29·0	11·2	10·8		
Silos, Burgos	8. 8. 4. 113	♂	41·0	23·6	4·6	17·2	11·0	12·0	13·2	28·4	11·0	11·0	,,	,,
,, ,,	8. 8. 4. 19	♂	42·0	24·2	4·6	18·0	11·2	12·0	13·0	27·4	10·2	10·0		
,, ,,	172164		42·2	24·6	5·0	17·8	11·0	11·8	14·0	28·6	10·4	10·4	,,	,,
,, ,,	8. 8. 4. 115	♀*	42·0	23·4	4·4	17·0	11·0	11·6	13·6	28·0	10·6	10·8	,,	,,
,, ,,	172157	♀	40·4	24·0	5·0	17·0	10·8	11·0	13·0	27·4	10·4	10·6		
,, ,,	172163	♀	42·4	23·4	4·8	17·2	11·0	12·4	14·0	28·8	10·6	11·0	,,	,,
Barracas, Castellon	8. 2. 9. 160	♂	44·4	25·0	4·4	18·6	10·6	13·0	14·8	29·4	10·8	11·0	,,	,,
,, ,,	8. 2. 9. 163	♂	43·0	25·2	4·6	19·0	11·4	11·6	14·2	29·2	11·0	11·0	,,	,,
,, ,,	8. 2. 9. 165	♂	42·4	24·6	4·2	19·0	10·4	11·8	13·8	28·0	11·0	10·4		
,, ,,	8. 2. 9. 170	♀	41·6	25·0	4·4	18·0	11·4	12·4	13·0	28·4	11·0	11·0	,,	,,
Seville	95. 3. 3. 26	♂	40·4	25·0	5·0	18·0	11·0	12·0	13·4	28·6	10·4	10·2	,,	nearly joined.
Venta del Baul, Granada	8. 8. 4. 119	♀	41·8	24·8	5·0	18·6	10·2	11·8	13·6	29·4	10·8	10·6		
A. sapidus tenebricus.														
France: l'Hospitalet, Ariège	8. 8. 4. 256	♂	41·4	22·6	4·6	17·6	10·4	11·6	13·0	27·0	10·0	10·0		
Biarritz, Basses-Pyrénées	152930	♂	40·0	24 0	5·0	18·0	11·0	11·6	12·8	27·6	11·0	11·0		
,, ,,	6. 1. 21. 5*	♂	41·6	24·0	4·4	17·8	10·4	12·0	13·0	26·8	10·6	10·2	,,	joined, low.
,, ,,	6. 1. 21. 10	♂	42·2	25·4	4·6	19·0	11·0	12·0	13·6	28·0	11·0	10·8		
,, ,,	6. 1. 21. 6	♀	42·0	24·4	4·0	18·0	11·0	11·0	13·4	28·0	11·0	10·4	,,	,,
,, ,,	6. 6. 4. 13	♀	40·8	24·4	4·8	18·0	10·4	11·2	13·0	26·8	10·0	10·0	,,	,,
,, ,,	6. 6. 4. 14	♀	41·0	23·4	4·6	17·8	10·8	11·2	13·4	26·8	10·2	10·8	,,	,,
Barsac, Gironde	2274 Lataste	♂	40·8	23·0	5·0	18·0	10·0	11·0	13·2	26·6	10·0	10·0	,,	nearly joined.

* Type.

ARVICOLA TERRESTRIS Linnæus.

1758. [*Mus*] *terrestris* Linnæus, Syst. Nat. I, 10th ed., p. 61 (Sweden).

1771. [*Mus*] *paludosus* Linnæus, Mantissa Plantarum, pt. 2, p. 522 (Sweden).

1827. [*Hypudæus terrestris*] β *ater* Billberg, Synopsis Faunæ Scandinaviæ, p. 4 (Gottland, Sweden).

1827. [*Hypudæus paludosus*] β *littoralis* Billberg, Synopsis Faunæ Scandinaviæ, p. 5 (Småland, Sweden).

1827. [*Hypudæus paludosus*] γ *aquaticus* Billberg, Synopsis Faunæ Scandinaviæ, p. 5 (South Sweden).

1858. *Arvicola amphibius* a. Blasius, Säugethiere Deutschlands, p. 344 (part).

1910. *Arvicola terrestris* Miller, Proc. Biol. Soc., Washington, XXIII, p. 20, March 23, 1910.

1910. *Arvicola terrestris* Trouessart, Faune Mamm. d'Europe, p. x.

Type locality.—Upsala, Sweden.

Geographical distribution.—Scandinavian Peninsula, eastward into Finland; limits of range not known.

Diagnosis.—Size less than in *Arvicola amphibius*, but general proportions not peculiar (head and body about 175 mm., tail about 100 mm., hind foot usually 28 to 31 mm., condylobasal length of adult skulls, 36 to 39 mm.); colour dark, essentially as in *A. amphibius*, but cheeks usually more yellowish than surrounding parts; skull slightly but evidently fossorial in form, the rostrum and occiput tending to be obliquely truncate, the upper incisors noticeably projecting forward; interparietal tending to be sub-quadrate in outline; teeth rather heavy, but roots of m_1 and m_2 never forming protuberances on lower surface of mandible; habits both aquatic and mole-like.

External characters.—Aside from the somewhat less robust general form correlated with the animal's smaller size there appear to be no tangible external characters to distinguish *Arvicola terrestris* from *A. amphibius*.

Colour.—Upper parts varying from broccoli-brown to mars-brown, heavily overlaid with black, the latter usually though not always in excess and producing a general effect not far from seal-brown, especially along median dorsal region; underparts a distinctly rusty ochraceous-buff, in some specimens almost tawny, everywhere dulled by the slaty under-colour, and fading on throat to an indefinite yellowish grey; cheeks and sides of head, frequently to and including ears, tinged with rusty like that of underparts, the suffusion usually producing a decided contrast with surrounding parts; feet varying from hair-brown to a deep blackish brown; tail blackish throughout, the under surface often sprinkled with greyish hairs.

Skull.—The skull is not so large as that of *Arvicola amphibius* or *A. sapidus*. In form it differs from the skulls of the strictly aquatic members of the genus in a decided tendency to assume a

fossorial structure. This is shown by the more pronounced forward projection of the upper incisors, and more particularly by the shortening and widening of the brain-case in general and the slightly greater obliquity of the occipital region. Flattened

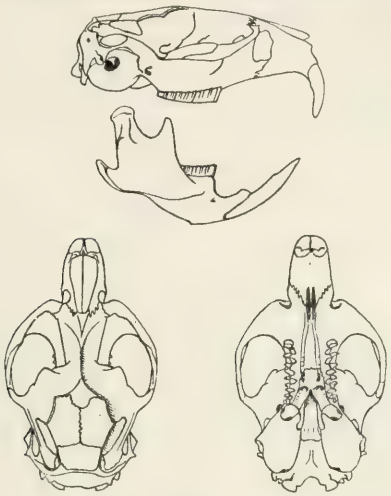

FIG. 153.
Arvicola terrestris. Nat. size.

area between lateral ridges on brain-case tending to assume a diamond-shaped outline rather than that of an irregular paralellogram. Antero-posterior diameter of interparietal usually more than half transverse diameter, the outer margins of the bone almost squarely truncate.

Teeth.—Except for their slightly smaller size the teeth exactly resemble those of *Arvicola amphibius*.

Measurements.—Adult female from Holme, Mandal, Norway: head and body, 167; tail, 99; hind foot, 29. Adult male from Christiania, Norway: tail, 105; hind foot, 29. Adult from Vefsen, Nordland, Norway: hind foot, 31; ear, 16. Adult female from Jemtland, Sweden: head and body, 187; tail, 104; hind foot, 30. Two adults from near Stockholm, Sweden: hind foot (dry), 27·6 and 29·4. For cranial measurements see Table, p. 742.

Specimens examined.—Thirty-eight, from the following localities:—
NORWAY:—Vefsen, Nordland, 1; Elverum, Hedemarken, 1 (U.S.N.M.); Christiania, 1 (U.S.N.M.); Asker, Christiania, 1 (U.S.N.M.); Holme, Mandal, 15.
SWEDEN:—Jemtland, 7; Upsala, 2 (B.M. and U.S.N.M.); Upland, 2

(U.S.N.M.); near Stockholm, 6 (B.M., U.S.N.M. and Stockholm); Aspvik, 1; Drottningholm, 1 (U.S.N.M.).

FINLAND:—Drumso, 1.

Remarks.—*Arvicola terrestris* is readily distinguishable from *A. amphibius* by its smaller size, brighter coloured cheeks, and by the slightly fossorial modification of the skull. In habits it is less strictly aquatic than the British animal.

1.	Vefsen, Nordland, Norway.	E. G. B. Meade Waldo (C & P).	5. 7. 1. 3.
6 ♂, ♀,	Holme, Mandal.	R. J. Cuninghame (C & P).	8. 8. 9. 19-29.
♂.	Upsala, Sweden. (*E. Kolthoff.*)	Lord Lilford (P).	0. 5. 15. 1.
2.	Near Stockholm.	Prof. Sundevall (P).	49. 11. 1. 12-13.
1 al.	Aspvik.	Stockholm Museum (E).	90. 8. 1. 14.
♀	Drumso, Finland.	Dr. Schulman (C & P).	1. 6. 9. 3.

ARVICOLA ITALICUS Savi.

1839. *Arvicola amphibius* var. *italica* Savi, Nuovo Giorn. de' Letterati, Pisa, XXXVII, No. 102, p. 202 (p. 5 of separate), February 1839 (for date see de Sélys-Longchamps, Micrommalogie, p. 93). Vicinity of Pisa, Italy.

1839. *Arvicola pertinax* Savi, Nuovo Giorn. de' Letterati, Pisa, XXXVII, No. 102, p. 203 (p. 6 of separate), February, 1839 (MS. synonym of *italica*).

1845. ? [*Arvicola amphibius* var. *minor* De Sélys-Longchamps, Atti della sesta Riunione degli Scienziati Italiani, Milano, 1844, p. 322 (nomen nudum).

1910. *Arvicola italicus* Miller, Proc. Biol. Soc. Washington, XXIII, p. 20, March 23, 1910.

910. *Arvicola italicus* Trouessart, Faune Mamm. d'Europe, p. x.

Type locality.—Vicinity of Pisa, Italy.

Geographical distribution.—Italian Switzerland and northern Italy, south at least to the vicinity of Pisa. Details of distribution not known.

Diagnosis.—Similar to *Arvicola terrestris*, but teeth not so heavy and colour not so dark, the underparts washed with yellowish brown instead of rusty, the cheeks not contrasting noticeably with surrounding parts.

Colour.—Elements of colour of upper parts essentially as in *Arvicola terrestris*, but broccoli-brown much in excess of black, the latter producing a slight effect of grizzling or "lining," but never sufficiently dominant to make the general colour approach seal-brown; sides light, buffy, slightly grizzled wood-brown, becoming a little more yellowish on cheeks. Underparts light slaty grey washed with buffy on chest and belly. Feet a light hair-brown, sometimes tinged with drab. Tail obscurely bicolor, dark brown above, greyish below.

Skull and teeth.—The skull resembles that of *Arvicola terrestris* in size and general appearance, but the brain-case is deeper and noticeably longer in proportion to its breadth, the general outline thus approaching that of the large numbers of the group. Auditory bullæ slightly larger than in the Scandinavian species, but not peculiar in form. Teeth as in *A. terrestris*, but slightly larger.

Measurements.—Average and extremes of five adults from Lugano, Ticino, Switzerland: head and body, 180·6 (174–191); tail, 87·8 (84–90); hind foot, 27·7 (27–29). Adult male and female from Locarno, Ticino, Switzerland: head and body, 179 and 171; tail, 102 and 98; hind foot, 29 and 27·5; ear, 15·5 and 16. Adult female from Ceresole d'Alba, Turin, Italy: head and body, 163; tail, 90; hind foot, 29. For cranial measurements see Table, p. 743.

Specimens examined.—Twenty-nine, from the following localities:—
SWITZERLAND: Lugano, Ticino, 19 (U.S.N.M. and Mottaz); Locarno, Ticino, 4.
ITALY: Casaleone, Verona, 1 (U.S.N.M.); Modena, 3; Ceresole d'Alba, Turin, 1 (Turin); no exact locality, 1.

2 ♂, 2 ♀.	Locarno, Ticino, Switzerland.	O. Thomas (C & P).	2. 7. 1. 2–5.
♀, 2 juv. al.	Modena, Italy.	Marquis G. Doria (P).	90. 3. 5. 1–3.
1.	Italy.	Purchased (Brandt).	46. 1. 9. 20.

ARVICOLA ILLYRICUS Barrett-Hamilton.

1899. *Microtus musignani illyricus* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., III, p. 225, March, 1899. Type in British Museum.
1910. *Arvicola illyricus* Miller, Proc. Biol. Soc. Washington, XVIII, p. 21, March 23, 1910.
1910. *Arvicola illyricus* Trouessart, Faune Mamm. d'Europe, p. x.

Type locality.—Bosnia, no exact locality.

Geographical distribution.—Bosnia. Limits of range not known.

Diagnosis.—Similar to *Arvicola italicus*, but underparts with a decided whitish wash.

Colour.—The colour is in all respects similar to that of *Arvicola italicus*, except that the chest and belly are a whitish grey, with only the faintest tinge of buff.

Skull and teeth.—The imperfect skull of the type shows nothing to distinguish it from that of *Arvicola italicus*.

Measurements.—Type: hind foot, 30; ear, 15. For cranial measurements see Table, p. 743.

Specimen examined.—The type.

Remarks.—The Bosnian water vole is so similar to *Arvicola italicus* that the two animals will not improbably prove to be

CRANIAL MEASUREMENTS OF *ARVICOLA TERRESTRIS*, *A. ITALICUS*, *A. ILLYRICUS* AND *A. MUSIGNANI*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Occipital breadth.	Occipital depth.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
A. terrestris.													
Norway, Holme, Mandal	—		—	23·2	4·6	16·6	10·0	—	—	25·6	9·6	9·6	Ridges joined, high.
,, ,,	8. 8. 9. 21		38·4	—	4·4	16±	10·0	11·0	13·0	25·0	9·4	9·2	,, joined, low.
,, ,,	8. 8. 9. 24	♂	—	—	4·6	—	—	10·4	12·8	25·2	9·4	9·4	,, ,,
,, ,,	8. 8. 9. 25		36·2	22·2	4·8	16·6	9·6	10·0	12·6	25·0	8·8	8·8	,, ,,
Sweden: Jemtland .	152946	♂	37·8	21·6	5·0	16·6	10·0	10·2	13·2	24·8	9·0	8·8	,, ,,
,, . .	152948	♀	38·8	23·0	4·8	17·8	10·2	11·2	13·0	25·2	9·6	9·2	,, ,,
Aspvik . .	90. 8. 1. 14	♂	38·4	23·6	5·0	18·0	10·8	11·6	13·2	26·0	10·0	9·8	,, joined
Stockholm .	Stockholm		36·2	21·8	5·0	16·4	9·6	9·6	13·8	24·2	8·8	9·0	,, joined, low.
,, .	49. 11. 1. 27	♀	36·4	22·6	5·0	18·4	10·0	10·0	12·4	23·4	9·4	9·6	,, ,,
,, .	431 Stockholm		38·8	—	4·6	17·0	9·8	10·0	13·2	25·0	9·0	9·2	,, joined, high.
Upsala . .	0. 5. 15. 1	♂	37·0	—	5·0	18·8	10·6	9·8	12·6	24·0	9·0	9·0	,, joined, low.
Drottningholm	37619	♂	36·8	22·2	4·8	16·6	9·6	9·6	12·6	24·8	9·0	9·2	,, joined, moderate.

A. italicus.													
Switzerland: Locarno, Ticino.	2. 7. 1. 2	♂	38·2	23·4	5·0	17·4	10·2	10·4	12·6	25·0	10·0	10·0	Fully adult.
,, ,,	2. 7. 1. 3	♂	37·0	22·8	4·8	17·0	10·2	10·2	12·0	25·0	10·0	10·0	,,
,, ,,	2. 7. 1. 4	♀	37·4	22·0	4 6	17·0	10·2	10·0	12·0	25·0	10·0	10·0	,,
,, ,,	2. 7. 1. 5	♀	38·0	23·0	4·8	16·8	10·0	11·0	12·4	25·6	10·0	10·6	,,
Lugano, Ticino .	105819	♀	37·2	22·2	5·2	16·0	10·4	9·8	11·8	25·0	9·2	9·8	Ridges joined, low.
,, ,,	105820	♀	36·4	22·0	5·0	15·8	10·4	10·0	12·0	24·8	9·2	9·2	,, ,,
,, ,,	111554	♀	37·8	23·2	5·0	16·4	10·4	10·4	12·6	25·6	9·2	9·8	,, ,,
,, ,,	105818	♀	36·2	—	5·2	15·8	10·4	9·8	11·8	24·8	9·4	9·6	,, nearly joined.
Italy: Casaleone, Verona	152939	♀	36·2	21·4	5·0	—	—	9·4	12·0	24·6	9·6	9·4	,, ,,
Ceresole d'Alba, Turin . .	Turin	♀	37·4	23·6	5·0	17·6	10·0	—	12·0	25·2	10·0	9·8	,, joined.
Modena . .	90. 3. 5. 3	♀	36·4	21·6	5·2	16·0	9·6	9·0	12·2	24·0	8·8	9·0	,, nearly joined.
A. illyricus.													
Bosnia	94. 1. 5. 1*		—	23·0	4·6	—	—	10·2	12·6	26·0	9·8	9·6	,, joined, low.
A. musignani.													
Italy: Velletri, Rome .	2361 Mottaz	♂	36·4	21·6	5·2	16·0	9·6	9·0	12·2	24·0	8·8	9·0	,, nearly joined.
Arsoli, Rome .	152935	♂	37·4	23·2	4·8	16·2	10·0	9·6	12·2	24·8	9·6	9·6	,, joined, low.
,, ,, .	152936	♀	38·6	24·2	4·8	17·2	10·0	10·0	13·0	26·2	9·6	9·4	,, ,,

* Type.

identical. A specimen from Breba, Roumania, in some respects resembles the type of *Arvicola illyricus*, but the small size of the hind foot (25 mm.) renders its identification uncertain.

♂.	Bosnia.	Dr. Floericke (c).	94. 1. 5. 1. (*Type* of species.)
♂.	Breba, Roumania. (*W. Dodson.*)	Lord Lilford (p).	4. 4. 6. 66.

ARVICOLA MUSIGNANI de Sélys-Longchamps.

1839. *Arvicola musignani* de Sélys-Longchamps, Revue Zoologique, p. 8, January, 1839 (Rome, Italy).

1839. *Arvicola destructor* Savi, Nuovo Giorn. de' Letterati, Pisa, XXXVII, No. 102, p. 204 (p. 7 of separate), February, 1839. (Maremma Grossetana, Tuscany, Italy). For date of publication see de Sélys-Longchamps, Micromammalogie, p. 93.

1845. ? [*Arvicola musignani*] var. *fuliginosus* de Sélys-Longchamps, Atti della sesta Riunione degli Scienziati Italiani, Torino, 1844, p. 322 (nomen nudum).

1857. *Arvicola amphibius* b. Blasius, Säugethiere Deutschlands, p. 344.

1910. *Arvicola musignani* Miller, Proc. Biol. Soc. Washington, XXIII, p. 21, March 23, 1910.

1910. *Arvicola musignanoi* Trouessart, Faune, Mamm. d'Europe, p. x.

Type locality.—Vicinity of Rome, Italy.

Geographical distribution.—Central Italy; at present known from the west coast only.

Diagnosis.—Size and general characters as in *Arvicola italicus*, but colour pale and yellowish, like that of *A. sapidus sapidus*.

Colour.—Entire animal a light yellowish wood-brown, faintly grizzled with black on median dorsal region and clouded by the slate-grey underfur on throat and belly; cheeks faintly more yellowish than sides of body. Feet light drab. Tail obscurely bicolor, blackish brown above, yellowish brown below.

Skull and teeth. The skull and teeth agree with those of *A. italicus*, except that the molars appear to be usually somewhat smaller.

Measurements. Two adult males from Arsoli, Rome, Italy: head and body, 190 and 201; tail, 94 and 95; hind foot, 29·6 and 29; ear, 15 and 15. For cranial measurements see Table, p. 743.

Specimens examined.—Seven, from the following localities in Italy: Arsoli, Rome, 6; Velletri, Rome, 1 (Mottaz).

♂.	Arsoli, Rome, Italy.	G. Barrett-Hamilton (p).	11. 1. 2. 37.

ARVICOLA SCHERMAN Shaw.

(Synonymy under subspecies.)

Geographical distribution.—West-central continental Europe, from the Pyrenees and Alps to the Baltic: eastern limits of range not known.

Diagnosis.—Essentially as in *Arvicola terrestris*, but more modified for fossorial life, some of the races having become completely terrestrial; palmar and plantar tubercles reduced, occupying less than half surface of region in which they occur; skull distinctly fossorial in form, the incisors strongly protruding; interparietal tending to be narrow and ligulate in outline.

Skull and teeth.—The skull does not differ essentially from that of *Arvicola terrestris*, but its fossorial characters are more accentuated, especially in the terrestrial forms. Teeth without special peculiarities.

Remarks.—It may eventually be shown that some form of *Arvicola scherman* intergrades with *A. terrestris*, but so far as the material examined is concerned the two animals, though nearly related, are distinct. Three races are now known, one of them partly acquatic in its habits, the two others strictly terrestrial.

Arvicola scherman scherman Shaw.

1779. ? *S[palax] minor* Leske, Anfangsgrunde der Naturgesch., I, p. 168 (Germany).

1801. *Mus scherman* Shaw, Gen. Zool., II, pt. I, p. 75 (Strassburg, Germany).

1801. *M[us] amph[ibius] albus* Bechstein, Gemeinn. Naturgesch. Deutschlands, I, 2d ed., p. 985 (Thüringen, Germany).

1801. *M[us] amph[ibius] canus* Bechstein, Gemeinn. Naturgesch. Deutschlands, I, 2d ed., p. 985 (Thüringen, Germany).

1804. *Mus terrestris* Hermann, Observ. Zool., p. 59 (not of Linnæus, 1758).

1804. [*Mus*] *schermaus* Hermann, Observ. Zool., p. 59. Alternative for *terrestris*; proposed but rejected on the ground that the animal was the same as that of Linnæus (Strassburg, Germany).

1822. *Arvicola argentoratensis* Desmarest, Mammalogie, pt. II, p. 281 (Strassburg, Germany).

1829. *Lemmus arvalis β buffonii* Fischer, Synops. Mamm., p. 293 (near Berlin, Germany?). Based on Brants's account (Het Geschlact der Muizen, p. 372) of two specimens in the Berlin Museum supposed to be identical with the dark variety of "Le Campagnol" described by Buffon, Hist. Nat. des Anim. VII, p. 372.

1839. *Arvicola terrestris* de Sélys-Longchamps, Études de Micromamm., p. 97, pls. I and II, fig. 6.

1858. *Arvicola amphibius*, c. *A[rvicola] terrestris* auct., Blasius, Säugethiere Deutschlands, p. 355 (part).

1910. *Arvicola scherman scherman* Miller, Proc. Biol. Soc. Washington, XXIII, p. 21, March 23, 1910.

1910. *Arvicola scherman* Trouessart, Faune Mamm. d'Europe, p. x.

Type locality.—Strassburg, Germany.

Geographical distribution.—Continental Europe from the Baltic south into central France and southern Germany; limits of range imperfectly known.

Diagnosis.—Sole wrinkled but not conspicuously granular; palmar and plantar tubercles relatively smaller than in *Arvicola terrestris*, though not so much reduced as in the strictly terrestrial forms; length of hind foot about 26·5 mm.; condylobasal length

of fully adult skulls, 35·6 to 36·4 mm.; colour of upper parts a dark brown, usually much clouded with black; tail usually dark brown throughout. Habits partly terrestrial and partly aquatic.

External characters.—General form essentially as in *Arvicola terrestris*. Palmar and plantar tubercles distinctly reduced as compared with those of the Scandinavian animal; sole wrinkled near heel but not distinctly granular, and without evident pubescence.

Colour.—Upper parts a dark brown, usually approaching the prout-brown of Ridgway along median dorsal area from muzzle to base of tail, and mars-brown or broccoli-brown on sides. In some specimens there is a general suffusion of light wood-brown, and the sides may even show a faint tinge of dull buffy grey. Cheeks concolor with sides or nearly so, seldom if ever forming any noticeable contrast with surrounding parts. Chest and belly slaty grey variously washed with dull ochraceous-buff, the throat usually about the slate-grey of Ridgway. Feet varying from hair-brown to blackish. Tail blackish throughout or sprinkled with whitish hairs below, never distinctly bicolor.

Measurements.—Adult female from Brunswick, Germany: head and body, 171; tail, 102; hind foot, 27. Three adults from Nuremberg, Germany: hind foot, 26, 26·6 and 27. For cranial measurements see Table, p. 750.

Specimens examined.—Forty-three, from the following localities:—
Belgium: Waremme, Liége, 3 (U.S.N.M.).
France: La Ferté-Milon, Aisne, 1 (Lataste).
Germany: Stolpin, Pomerania, 1; Brunswick, 3 (U.S.N.M. and Merriam); Ingelheim, Rheinhessen, 7; Heidelberg, Baden, 1 (U.S.N.M); Lotzen, Saxony, 1 (U.S.N.M.); Ummerstadt, Thüringen, 1; Strass, near Burgheim, Bavaria, 5; Marxheim, near Monheim, Bavaria, 1; Nuremberg, Bavaria, 6 (U.S.N.M.); South Germany (no exact locality), 2; Strassburg, Alsace, 1; Niesky, Silesia, 2.
Austria-Hungary: Hainspach, Bohemia, 4 (U.S.N.M.); Zubereč, 4.

1 al.	Stolpin, Pomerania.	Dr. H. Gadow (c & p).	82. 7. 31. 1.
4 ♂, 3 ♀.	Ingelheim, Rheinhessen.	C. Hilgert (c).	8. 11. 2. 52-58.
♀.	Strassburg, Alsace. (*C. Mottaz.*)	O. Thomas (p).	8. 8. 10. 100.
♂, juv.	Niesky, Silesia. (*W. Baer.*)	Dr. E. Hamilton (p).	97. 12. 4. 31–32
4.	Zubereč, Hungary.	Budapest Museum (e).	94. 3. 1. 61–64.

Arvicola scherman exitus Miller.

1839. *Arvicola terrestris* Savi, Nuov. Giorn. de' Letterati, Pisa, xxxvii, p. 300 (p. 3 of separate). Not *Mus terrestris* Linnæus. (Geneva, Switzerland.)

1845. ? [*Arvicola terrestris*] var. *niger* De Sélys-Longchamps, Atti della sesta Riunione degli Scienziati Italiani, Milano, 1844, p. 321 (Lausanne, Switzerland). Nomen nudum.

1845. ? [*Arvicola terrestris*] var. *castaneus* De Sélys-Longchamps, Atti della sesta Riunione degli Scienziati Italiani, Milano, 1844, p. 321 (Lausanne, Switzerland). Nomen nudum.

1857. *Arvicola amphibius* c. *A[rvicola] terrestris* Auct., Blasius, Säugethiere Deutschlands, p. 355 (part).

1910. *Arvicola scherman exitus* Miller, Proc. Biol. Soc. Washington, XXIII, p. 21, March 23, 1910 (St. Gallen, Switzerland). Type in British Museum.

1910. *Arvicola scherman exitus* Trouessart, Faune Mamm. d'Europe, p. x.

1911. *Arvicola scherman exilis* Lydekker, Zool. Record, XLVII (1910), Mamm., p. 54 (Accidental renaming of *exitus*).

Type locality.—St. Gallen, Switzerland.

Geographical distribution.—Alps (not known from the Italian side) at moderate altitudes, and immediately adjoining lowlands of Switzerland and France; eastward into Tirol; northward into the Vosges Mountains; limits of range not known.

Diagnosis.—Sole nearly smooth; palmar and plantar tubercles much reduced, occupying distinctly less than half area of region in which they occur; length of hind foot, 22 to 25 mm.; condylobasal length of fully adult skulls, 33 to 35 mm.; colour of upper parts a light yellowish brown, usually without much black clouding; tail buffy throughout or evidently bicolor (never uniformly blackish); auditory bullæ not highly inflated, their surface often irregularly flattened; anterior loop of m_1 short and wide. Habits strictly terrestrial, mole-like.

External characters.—Compared with *Arvicola amphibius* this animal shows the following peculiarities in external form. Upper incisors more conspicuously protruding from mouth, and lower teeth also much exposed, the lower lip apparently too short to cover them. Front foot with anterior tubercles much more reduced as compared with posterior pair, the three together scarcely half as large as postero-external pad. (In *A. amphibius* the three anterior tubercles together decidedly exceed bulk of postero-external pad.) Hind foot showing only a slight tendency to "feathering." Sole with posterior portion nearly smooth. Plantar tubercles occupying decidedly less than half surface of area in which they occur, their size noticeably less than corresponding pads at base of claws; that at base of first digit scarcely larger than a dust shot; that at base of fifth toe about three times as large, and sub-equal to the two other anterior pads; postero-internal tubercle larger and more elongate than any of the others, but less noticeably so than in *A. amphibius*. An exceedingly rudimentary sixth tubercle sometimes present. Tail with annulations narrower than in *A. amphibius*, about 20 to the centimeter at middle.

Colour.—Upper parts varying from a light broccoli-brown to ochraceous-buff, the face, crown and median dorsal area faintly darkened by blackish hair-tips, these usually most noticeable in lumbar region; sides in brightest specimens clear ochraceous-buff, in others more nearly a greyish cream-buff; underparts a paler, less slaty grey than in *M. scherman scherman*, the throat nearly the grey No. 9 of Ridgway; chest and belly washed with cream-buff; feet ecru-drab, sometimes with a buffy tinge; tail

whitish throughout or sprinkled with blackish above, sometimes rather distinctly bicolor.

Skull and teeth.—The skull is slightly smaller than that of *Arvicola scherman scherman* (condylobasal length in fully adult specimens seldom if ever exceeding 35 mm.), and the fossorial characteristics, particularly the shallowness of the rostrum as

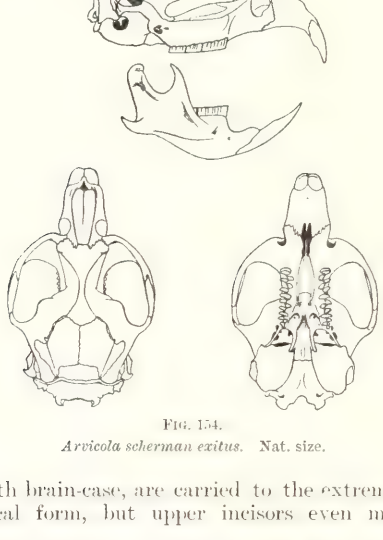

FIG. 154.
Arvicola scherman exitus. Nat. size.

compared with brain-case, are carried to the extreme. Teeth as in the typical form, but upper incisors even more strongly projecting.

Measurements.—External measurements of type (adult female): head and body, 138; tail, 64; hind foot, 24; ear, 13. Average and extremes of eight adults from the type locality: head and body, 146·6 (135–165); tail, 62·7 (56–70); hind foot, 23·7 (23–25). Adult male and female from Vitznau, Lucerne, Switzerland: head and body, 131 and 133; tail, 67 and 61; hind foot, 24·5 and 23·5; ear, 13 and 12. Average and extremes of six adults from Les Plans, Vaud: hind foot, 23·3 (23–25). Average and extremes of five adults from Cranves-Sales, Haute-Savoie, France: head and body, 138 (135–140); tail, 54 (52–57); hind foot, 22·5 (22–23); ear, 11·8 (11–12). For cranial measurements see Table, p. 750.

Specimens examined.—Eighty-two, from the following localities:—
FRANCE: Gerbamont, near Vagney, Vosges, 6 (Lataste); Cranves-Sales, Haute-Savoie, 8; Lucinges, Haute-Savoie, 4; Montauban, Haute-Savoie, 2; Scientriers, Haute-Savoie, 1 (Mottaz); Étupes, Doubs, 1 (Mottaz; not typical).

SWITZERLAND: Geneva, 9 (B.M. and Mottaz); Nyon, Vaud, 1 (Mottaz); Chesières, Vaud, 2 (Mottaz); St. Cergues, Vaud, 1 (Mottaz); Lausanne, Vaud, 2 (U.S.N.M.); Les Plans, Vaud, 10 (U.S.N.M.); Meiringen, Berne, 6 (U.S.N.M.); Vitznau, Lucerne, 2; St. Gallen, 13 (B.M. and U.S.N.M.); Mels, S. Gallen, 4 (U.S.N.M.); Züberwangen, St. Gallen, 2 (B.M. and U.S.N.M.); Roggweil, Thurgau, 3 (U.S.N.M.); Fribourg, 1; no exact locality, 3.

AUSTRIA-HUNGARY: Mittelberg, Vorarlberg, 1.

Remarks.—This form is immediately distinguishable from *A. scherman scherman* by its smaller size, yellower colour, and more complete adaptation to underground life. Its habits so far as known are strictly terrestrial and mole-like.

2 ♂.	Cranves-Sales, Haute-Savoie, France.	A. Robert (C & P).	5. 4. 9. 6–7.
3 ♂, 3 ♀.	Cranves-Sales, Haute-Savoie. 1200 m. (*A. Robert.*)	O. Thomas (P).	5. 11. 18. 18–23.
2.	Montauban, Haute-Savoie.	A. Robert (C & P).	97. 1. 9. 5–6.
1.	Geneva, Switzerland.	Baron de Sélys-Longchamps (P).	55. 12. 24. 358.
♂, ♀.	Vitznau, Lucerne.	O. Thomas (C & P).	5. 8. 3. 19–20.
♂.	Züberwangen, St. Gallen. (*E. H. Zollikofer.*)	O. Thomas (P).	2. 8. 4. 48.
4 ♂, 4 ♀.	St. Gallen. (*E. H. Zollikofer.*)	O. Thomas (P).	10. 8. 16. 1–8. (10. 8. 16. 8. Type of subspecies.)
1.	Fribourg.	L. O. Galliard (P).	75. 9. 20. 1.
1.	Switzerland.	Baron de Sélys-Longchamps (P).	45. 7. 5. 5.
2.	Switzerland. (*Möschler.*)	E. R. Alston (P).	79. 9. 25. 47–48.
1.	Mittelberg, Vorarlberg, Austria-Hungary. (*Dr. Major.*)	O. Thomas (P).	8. 11. 30. 17.

ARVICOLA SCHERMAN MONTICOLA de Sélys-Longchamps.

1838. *Arvicola monticola* de Sélys-Longchamps, Revue Zoologique, p. 249.
1839. *Arvicola monticola* de Sélys-Longchamps, Études de Micromamm., p. 92, pls. I and II, fig. 3.
1858. *Arvicola amphibius*, c. *A[rvicola] terrestris* auct., Blasius, Säugethiere Deutschlands, p. 355 (part).
1910. *Arvicola scherman monticola* Miller, Proc. Biol. Soc. Washington, XXIII, p. 22, March 23, 1910.
1910. *Arvicola scherman monticola* Trouessart, Faune Mamm. d'Europe, p. x.

Type locality.—St. Bertrand de Comminge, Hautes-Pyrénées, France.

Geographical distribution.—Pyrenees and their immediate neighbourhood (known at present from the French side only); Puy-de-Dôme?

Diagnosis.—Like *Arvicola scherman exitus*, but auditory bullæ usually larger and more evenly inflated, and first lower molar with anterior loop longer and narrower than in the Alpine form. Habits strictly terrestrial, mole-like.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Occipital breadth.	Occipital depth (median).	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
A. scherman scherman.													
Belgium: Waremme, Liége	85545		34·0	20·8	4·2	16·2	9·8	9·0	11·8	23·0	8·6	9·0	Ridges joined, low.
,, ,,	86019	♀	35·2	22·2	5·0	16·2	10·0	8·6	11·6	23·8	8·8	9·0	,, ,,
France: La Ferté-Milon	2108 Lataste	♂	36·6	23·8	5·0	17·2	10·0	10·2	12·8	25·0	8·8	9·0	,, joined high.
Germany: Brunswick	85247	♀	35·6	21·4	4·2	15·8	9·8	10·0	12·0	23·8	8·8	9·0	,, ,,
Lotzen, Saxony	120960	♂	35·6	—	4·6	—	9·8	9·8	11·8	24·0	9·0	9·2	,, joined low.
Nuremberg, Bavaria	37614		35·6	22·0	4·8	16·4	9·2	9·8	12·2	23·4	8·8	8·8	,, nearly joined.
Strass, near Burgheim, Bavaria	152953	♀	32·8	20·6	4·4	14·8	8·8	8·8	11·6	22·6	8·2	8·2	,, joined, low.
,, ,, ,,	152954	♀	34·4	21·8	5·0	16·0	9·6	9·6	11·6	23·2	8·8	9·0	,, ,,
Marxheim, Bavaria	152958	♂	34·2	21·4	4·8	15·4	9·2	8·2	12·0	22·6	8·4	8·6	,, ,,
Ingelheim, Rheinhessen	8. 11. 2. 53	♂	35·8	23·0	5·0	15·6	10·0	9·4	12·0	24·0	8·8	9·0	,, ,,
South Germany	484 h		36·4	22·6	5·0	17·0	10·0	—	12·8	—	9·0	—	,, ,,
,, ,,	484 l		35·6	22·0	4·8	16·8	9·6	9·0	12·0	21·4	8·6	8·2	,, nearly joined.
A. scherman exitus.													
France: near Vagney, Vosges	1849 Lataste		34·4	21·4	4·8	15·4	9·0	9·2	11·8	23·4	8·6	8·8	,, joined, low.
,, ,,	1852 ,,		34·2	20·8	3·8	16·0	9·0	8·8	11·8	23·2	8·2	8·4	,, ,,
,, ,,	1853 ,,		32·6	21·0	4·2	15·2	9·0	8·4	11·4	22·4	8·2	8·4	,, ,,
Montauban, Haute-Savoie	152967	♀	32·2	20·0	4·8	15·0	8·6	8·6	11·6	22·0	8·0	8·2	,, low, separate.

France: Montauban, Haute-Savoie	152968	♂	32·8	20·2	4·4	15·2	9·0	9·2	11·8	22·2	8·0	8·4	Ridges nearly joined.
Cranves-Sales, Haute-Savoie	5. 4. 9. 6	♂	33·2	21·6	4·6	15·0	9·2	8·4	11·8	22·8	8·2	8·4	,, joined.
,, ,,	5. 11. 18. 21	♀	34·0	21·0	4·6	16·0	9·0	8·8	12·0	22·4	8·2	8·8	,, not joined.
Lucinges, Haute-Savoie	152978	♀	32·2	19·8	4·2	15·0	8·6	9·0	11·6	22·2	8·0	8·2	,, nearly joined.
Switzerland: Geneva	291 Mottaz	♂	34·0	21·0	4·6	15·0	9·2	8·4	12·0	22·4	8·0	8·2	,, joined, high.
Chesières, Vaud	2203 ,,	♂	33·6	20·6	4·8	15·4	9·0	9·2	12·4	22·0	8·0	8·2	
,, ,,	2204 ,,	♀	34·0	21·0	4·8	16·0	9·0	9·2	12·4	22·6	8·0	8·0	
Vitznau	5. 8. 3. 19	♂	33·6	21±	4·2	15·6	9·0	9·0	12·2	22·6	8·4	8·8	,, joined.
,,	5. 8. 3. 20	♀	32·8	20·6	4·4	15·0	8·8	7·6	11·8	22·4	8·0	8·8	,, nearly joined.
St. Gallen	10. 8. 16. 8*	♀	33·8	20·4	5·0	15·4	9·4	9·0	12·0	23·0	8·6	9·0	,, joined, low.
,,	115255	♂	34·2	21·6	4·6	15 2	9·2	8·8	11·4	23·0	8·0	8·4	,, ,,
,,	152963	♂	33·0	—	4·8	15·2	8·8	8·6	11·8	22·2	8·2	8·4	,, nearly joined.
,,	115256	♀	33·6	20·8	4·8	15·8	9·2	9·4	11·6	23·4	8·0	8·2	,, ,,
Züberwangen, St. Gallen	2. 8. 4. 48	♂	35·0	21·0	4·8	16·0	9·2	9·8	12·4	23·4	8·2	8·6	,, ,,
Mels ,,	105810	♀	32·4	21·6	4·6	15·0	9·4	9·2	11·8	22·8	8·2	8·4	,, ,,
Degersheim ,,	123594	♀	35·0	21·6	4·0	15·6	8·8	9·2	12·0	23·4	8·2	8·6	,, joined.
A. scherman monticola.													
France: Caterille, Haute-Garonne	152970	♂	34·2	21·2	4·4	15·4	9·6	9·2	12·2	23·6	8·2	8·2	,, ,,
,, ,,	152971	♂	34·4	21·4	4·8	16·0	9·2	9·4	12·2	23·6	8·2	8·4	,, ,,
,, ,,	152972	♀	34·6	21·0	4·4	16·0	9·4	10·0	12·4	23·2	8·4	8·8	,, ,,
Luchon	152975	♂	34·2	20·6	4·2	15·6	9·0	9·2	12·2	22·8	8·2	8·4	,, ,,
Pyrenees, no exact locality	45. 7. 5. 4		35±	24·2	—	18±	10±	—	13·0	24·8	9·0	9·0	
,, ,,			35·0	23·0	4·8	17·0	9·0	9·8	12·4	24·0	9·0	8·8	
Biarritz, Basses-Pyrénées	6. 6. 4. 15	♂	33·2	21·4	4·8	15·6	9·8	8·0	11·8	22·2	8·0	8·4	,, nearly joined.
,, ,,	6. 6. 4. 17	♂	32·0	21·4	4·6	15·6	9·0	8·0	11·0	22±	8·4	8·6	,, ,,
,, ,,	6. 6. 4. 19	♀	32·8	19·8	5·0	15·0	9·0	8·2	11·0	21·8	8·4	8·6	,, ,,
,, ,,	6. 6. 4. 20	♀	33·4	21·0	4·8	15·4	9·2	8·8	11·6	22·2	8·0	8·6	,, ,,

* Type.

Measurements.—Average and extremes of four adults from Caterille, Haute-Garonne, France: head and body, 147·2 (145–150); tail, 60·8 (59–67); hind foot, 24·3 (24–25); ear, 13 (12–14). Adult male from Luchon, Haute-Garonne, France: head and body, 150; tail, 58; hind foot, 25; ear, 12. Average and extremes of four adults from Biarritz, Basses-Pyrénées, France: head and body, 144·7 (143–147); tail, 63·7 (62–66); hind foot, 23·5 (23–24); ear, 12·2 (12–13). For cranial measurements see Table, p. 751.

Specimens examined.—Twenty, from the following localities in south-western France: Caterille, Haute-Garonne, 4 (U.S.N.M.); Luchon, Haute-Garonne, 3 (U.S.N.M.); Biarritz, Basses-Pyrénées, 11; Pyrenees, no exact locality (probably topotypes), 4 (B.M. and U.S.N.M.).

Remarks.—The Pyrenean form of *Arvicola scherman*, though resembling the Alpine *A. scherman exitus* in colour, external characters and general form of skull, differs rather constantly in the greater inflation of the auditory bullæ and in the outline of the anterior loop of m_1.

Two mounted specimens in the Paris Museum, collected in the neighbourhood of Mont-Dore, Puy-de-Dôme, France (Nos. 1447 and 1510), while undoubtedly of the *exitus* type, are not, in their present condition, determinable with certainty. It is not impossible that they may be referable to the present race.

3 ♂, 5 ♀.	Biarritz, Basses-Pyrénées, France.	J. F. Davison (C & P).	6. 6. 4. 15–22.
1.	Pyrenees.	Baron E. de Sélys-Longchamps (P).	45. 7. 5. 4.
1.	Pyrenees.	Purchased (Frank).	45. 5. 23. 7.
1.	Pyrenees.	Stockholm Museum (E).	46. 6. 2. 66.

Genus **PITYMYS** McMurtrie.

1830. *Psammomys* Le Conte, Ann. Lyc. Nat. Hist., New York, III, p. 132 (*P. pinetorum* Le Conte). Not of Cretzschmar, 1828.

1831. *Pitymys* McMurtrie, Cuvier's Animal Kingdom, American edition, I, p. 434 (*Psammomys pinetorum* Le Conte).

1831. *Ammomys* Bonaparte, Saggio Distrib. Metod. Anim. Vert., p. 20, footnote (*Psammomys pinetorum* Le Conte).

1836. *Pinemys* Lesson, Hist. Nat. des Mammif. et Ois. découv. depuis 1788, Compl. Oeuvres de Buffon, V, p. 436 (*Psammomys pinetorum* Le Conte).

1857. *Microtus* Blasius, Säugethiere Deutschlands, p. 387 (sub-genus). Not *Microtus* Schrank, 1798.

1867. *Terricola* Fatio, Les Campagnols du Bassin du Léman, p. 36 (sub-genus to contain *Arvicola subterraneus* de Sélys-Longchamps, and *A. savii* de Sélys-Longchamps). Not of Fleming, 1828.

1877. *Microrus* Major, Atti della Soc. Toscana di Sci. Nat., III, p. 126 (sub-genus to contain *Arvicola nebrodensis* Mina-Palumbo).

1887. *Pitymys* Lataste, Ann. Mus. Civ. Stor. Nat. Genova, 2d ser., IV, p. 266 (subgenus).

1896. *Pitymys* Miller, North American Fauna, No. 12, p. 58, July 23, 1896 (sub-genus).

1907. *Pitymys* Mottaz, Bull. Soc. Zool. de France, xx, p. 27, September 1907 (genus).

Type species.—*Psammomys pinetorum* Le Conte.

Geographical distribution.—Central and southern continental Europe, eastward into Asia Minor; eastern and south-eastern United States; southern Mexico.

Characters.—Like *Microtus* but sole with five tubercles, and mammæ only four; external form slightly or considerably modified for underground life; skull in most species showing some trace of fossorial modification, this character often conspicuous; enamel pattern variable, but first inner and first outer triangles of m_1 broadly communicating.

Remarks.—The genus *Pitymys* is remarkable as the most conspicuous instance of discontinuous distribution in the subfamily. It is also the genus of European voles which presents the greatest diversity of cranial and dental characters. All the European members of the genus, twenty-five of which are here recognized, may at once be distinguished from the other voles occurring in the same region by the broad communication of the first inner and first outer triangles of m_1.

KEY TO THE EUROPEAN FORMS OF *PITYMYS*.

Third upper molar longer than second, its inner side normally with three re-entrant angles..... **subterraneus** group.

Dorsal profile of skull flat or faintly convex from nasals backward; brain-case much depressed, its depth including auditory bullæ about 65 per cent of occipital breadth.

Third inner re-entrant angle of m^3 shallow (Roumania)..... *P. dacius*, p. 760.

Third inner re-entrant angle of m^3 deep.

Back strongly suffused with buffy; feet whitish in noticeable contrast with back (Basses-Alpes)..... *P. druentius*, p. 762.

Back without noticeable buffy suffusion; feet dusky, not noticeably contrasting with back..... *P. subterraneus*, p. 755.

Brain-case moderately flattened; colour dark (Belgium to Transylvania)..... *P. s. subterraneus*, p. 758.

Brain-case much flattened; colour less dark (Puy-de-Dôme region, France)..... *P. s. capucinus*, p. 760

Dorsal profile of skull obviously convex from nasals backward; brain-case slightly depressed, its depth including auditory bullæ about 70 per cent of occipital breadth.

Condylobasal length of largest skulls about 23 mm.; dorsal profile of skull very slightly convex (Neighbourhood of Zermatt, Switzerland)..... *P. fatioi*, p. 763.

Condylobasal length of largest skulls about 25 mm.; dorsal profile of skull noticeably convex (Northern Italy, &c.)..... *P. multiplex*, p. 764.

Third upper molar not longer than second, its inner side normally with two re-entrant angles.
Outer triangles of m^3 well developed, with three definite enamel sides and a distinct central osteodentine area normally isolated or nearly so from that of inner triangle and posterior loop; middle outer salient angle as long as anterior and posterior salient angles (third inner re-entrant angle present in rare individual cases)..... **savii** group.
Brain-case much depressed, its dorsal profile nearly flat from nasal to back of interparietal (Pyrenees)..... *P. planiceps*, p. 772.
Brain-case not much depressed, its dorsal profile evidently convex.
Interparietal irregularly lozenge-shaped, its lateral extremities acute, scarcely or not in contact with temporals; first and second triangles of m^3 broadly communicating..... *P. gerbii*, p. 773.
Interparietal strap-shaped, its lateral extremities truncate, broadly in contact with temporals; first and second triangles of m^3 usually isolated.
General outline of brain-case sub-quadrate, the upper surface rather flat (Italy) ... *P. savii*, p. 768.
General outline of brain-case not evidently sub-quadrate, the upper surface rounded off at sides.
Mesopterygoid space rather wide (Sicily) *P. nebrodensis*, p. 770.
Mesopterygoid space narrow (South-western France)..... *P. pyrenaicus*, p. 770.
General colour above clear hair-brown without noticeable yellowish cast (Pyrenees)..... *P. p. pyrenaicus*, p. 771.
General colour above brown with a noticeable yellowish cast (Plains of south-western France)..... *P. p. brunneus*, p. 772.
Outer triangles of m^3 not well developed, usually opening widely into inner triangle and posterior loop, the central osteodentine area small or absent; middle outer salient angle noticeably shorter than anterior and posterior salient angles, sometimes nearly obsolete (third inner re-entrant angle never present)... **ibericus** group.
Upper incisors moderately long and not strongly projecting, not a highly conspicuous feature of skull as viewed from above.
Brain-case much flattened, the occipital depth about one-half occipital breadth (Central Spain)..... *P. depressus*, p. 779.
Brain-case not much flattened, the occipital depth noticeably more than one-half occipital breadth.
Upper incisors slightly projecting (Portugal) *P. lusitanicus*, p. 776.
Upper incisors nearly vertical.
Skull narrow; outline of brain-case distinctly elongate (North-western Spain)..... *P. mariæ*, p. 777.
Skull broad; outline of brain-case not specially elongated (North-central Spain)..... *P. pelandonius*, p. 778.

Upper incisors unusually long, and so strongly projecting as to be a highly conspicuous feature of skull as viewed from above.
Condylobasal length of fully adult skulls about 23 mm. (South-eastern France)..... *P. provincialis*, p. 785.
Condylobasal length of fully adult skulls 24 to 26·5 mm.
Size large, condylobasal length of largest skulls about 26·5 mm.; transverse diameter of auditory bulla about 7 mm. (Montenegro)..... *P. thomasi*, p. 786.
Size medium, condylobasal length of largest skulls not more than 25 mm.; transverse diameter of auditory bulla about 6 mm. or less.
Occiput so obliquely truncate that condyles are conspicuous when skull is viewed from above; interparietal narrowly ligulate (South-eastern France)..... *P. duodecimcostatus*, p. 784.
Occiput not very obliquely truncate, so that condyles are not highly conspicuous when skull is viewed from above; interparietal broadly ligulate or somewhat lozenge-shaped..... *P. ibericus*, p. 780.
Length of upper tooth-row about 5·4 mm. (Granada, Spain)..... *P. i. regulus*, p. 784.
Length of upper tooth-row 6 to 6·4 mm.
Colour above a dark bister brown (Dehesa de Valencia, Spain)..... *P. i. pascuus*, p. 783.
Colour above a light yellowish brown.
General colour above hair-brown with or without a buffy cast (Central Spain)..... *P. i. centralis*, p. 782.
General colour above a pale buffy broccoli-brown or drab (South-eastern Spain)..... *P. i. ibericus*, p. 782.

PITYMYS SUBTERRANEUS de Sélys-Longchamps.

(Synonymy under subspecies.)

Geographical distribution.—Central Europe from Belgium to central France, eastward through Switzerland to Transylvania. Details of distribution imperfectly known.

Diagnosis.—Size small (hind foot usually about 14·5 to 15·5 mm., condylobasal length of largest skulls, 22 to 23·4 mm.); skull slender and lightly built, depressed, the dorsal profile nearly flat or at most only a little convex from nasals backward; braincase much depressed, its depth including auditory bullæ about 65 per cent of occipital breadth; third upper molar noticeably longer than second, normally with three closed triangles, its posterior loop elongated and with deep inner re-entrant angle; general colour a clear dark brown without noticeable suffusion of buffy; feet dusky, not contrasting with colour of back.

External characters.—General external form essentially as in

Microtus arvalis, the tail about one-third as long as head and body, the feet slender and without special modification for burrowing, the incisors not protruding conspicuously from mouth. Ear small, but scarcely more so than in *Microtus arvalis*, its form with no special peculiarities except that meatal lobe is slightly less developed; both surfaces of ear conch essentially naked at base, thinly clothed with rather long hairs distally. Eye relatively smaller than in *Microtus arvalis*. Muzzle not peculiar. Front foot as in *Microtus arvalis*, except that the claws are slightly larger. Hind foot slender, its general form as in *M. arvalis*, the sole similarly hairy behind tubercles, the tubercles of the same form and relative size, their only peculiarity the complete absence of the sixth. Tail as in *M. arvalis*. Mammæ: 4, all inguinal.

Colour.—Upper parts usually a dark nearly uniform hair-brown, tinged with sepia along middle of back, everywhere inconspicuously varied by silvery reflections and blackish hair-tips; ground colour sometimes more nearly approaching mars-brown or wood-brown, but rarely if ever with any distinct buffy cast; basal portion of hairs slate-black; underparts pale smoke-grey, occasionally with a slight wash of broccoli-brown, the slaty bases of the hairs everywhere showing through at surface; feet an indefinite drab or dusky grey, often tinged with dark hair-brown; tail dull whitish grey beneath, dark brown above, the two colours sometimes though not usually well contrasted.

Skull.—The skull is smooth and lightly built, with large, somewhat flattened brain-case, rather wide interorbital region, and small rostrum. Dorsal profile nearly straight from near posterior extremity of nasals to a little behind middle of parietals, then slightly convex to posterior margin of interparietal, beyond which the occiput curves abruptly downward; nasals sloping forward at an angle of about 11°; ventral profile nearly straight from about middle of rostrum to lower border of auditory bullæ, the general outline of skull as viewed from the side rather narrowly cuneate. Brain-case long as compared with that portion of the skull which lies in front of it, the distance from back of interorbital constriction to hinder border of interparietal decidedly greater than breadth over roots of zygomata, its outline rather broadly oval, its surface smooth, or at most with slightly indicated ridges along outer sides of parietals; lambdoid crests slightly developed at sides; postorbital ridges low and indistinct, rarely if ever developing an angular projection;* interparietal narrowly ligulate, the outer extremities usually pointed, the anterior border with median projection; in lateral view the brain-case appears much flattened, its depth through auditory bullæ about 65 per cent of occipital breadth; occiput

* A character that often proves convenient in distinguishing between imperfect skulls of this species and the smaller forms of *Microtus*, in which the ridges are usually more developed and somewhat angular.

rounded off behind, not obliquely truncate, the occipital condyles barely visible when skull is viewed from above; paroccipital processes slender and inconspicuous, rather closely applied to surface of bullæ, their tips descending below lip of foramen magnum, the ridges extending upward from their bases slightly developed, much obscured by the somewhat unusual inflation of petrous portion of squamosal; floor of brain-case nearly smooth, but with slightly indicated median ridge; diameter of basioccipital along suture contained about two and one-half times in median length; auditory bullæ moderately large, about as in *Microtus arvalis*, though somewhat less evenly inflated, their anterior borders encroaching more deeply into ectopterygoid pits. Interorbital region short, abruptly though not deeply constricted, the least width usually greater than that of rostrum, the dorsal surface nearly flat, its outer edges becoming slightly angular in old age though never developing distinct ridges. Zygomata weak, scarcely expanded at middle, rather abruptly though not widely spreading, the two arches parallel through a considerable portion of their extent; deflection of arches slight, the median portion lying about at level of middle of skull; anteorbital foramen relatively smaller than in *Microtus arvalis*. Rostrum relatively weak, its least depth behind incisors about equal to width at same region; nasals rather noticeably narrowed behind middle, their posterior border squarely truncate at about level of middle of zygomatic root, the nasal branches of premaxillaries extending a little further backward; incisive foramina scarcely as large as in *Microtus arvalis*, their posterior extremity at level of front of m^1, their anterior extremity separated from incisors by distance equal to about twice their greatest combined breadth. Palate relatively somewhat wider than in *Microtus arvalis*, its surface less sharply sculptured; grooves moderately well-defined, but lateral pits usually rather shallow, their width slightly exceeded by the short, flattened median ridge; pterygoids nearly parallel, the hamulars slightly turned outward; mesopterygoid space rounded anteriorly; ectopterygoid pits relatively smaller than in *Microtus arvalis*. Mandible slender, with weak articular process, its general form essentially as in *M. arvalis*.

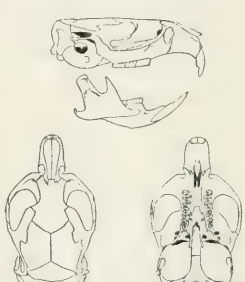

FIG. 155.

Pitymys subterraneus. Nat. size.

Teeth.—Upper incisors strongly curved, the roots forming slight protuberances in infraorbital foramina, the anterior portion nearly perpendicular, so that anterior surface is barely visible when skull is viewed from above; cross section of shaft obscurely triangular, the anterior border longest, slightly concave near

middle, the postero-external border shortest, the inner border nearly as long as anterior ; enamel extending over entire anterior border and outer fourth of inner border. Lower incisors slender, their roots extending well into bases of articular processes but not forming noticeable protuberances on outer surface of mandible ; cross section of shaft differing from that of upper tooth in the more triangular general outline and relatively shorter, strongly convex anterior border. Molars so like those of *Microtus arvalis* that aside from the peculiarities of the first mandibular tooth there is nothing to distinguish with certainty between the two patterns. Crown of third upper molar distinctly longer than that of second. In *Pitymys subterraneus* there is, however, a tendency for the re-entrant angles to be wider and the closed triangles relatively smaller, while the pattern of m^3 appears to be more subject to distortion. First outer triangle of m^3 not infrequently opening into inner triangle, but its apex always on level with that of anterior loop and second triangle. Second upper molar strictly as in *M. arvalis*. First lower molar like that of *Microtus arvalis* except that third inner re-entrant angle fails to penetrate to enamel wall of opposite side of tooth, thus having a broad area of communication between first inner and first outer triangles ; no exception to this condition has come under my observation.

FIG. 156.
Pitymys subterraneus. Enamel pattern. × 5.

Remarks.—Although bearing a strong superficial resemblance to *Microtus arvalis*, and more particularly to the Alpine *M. incertus*, this species is distinguishable externally by its rather smaller ears, and by the number of mammæ and plantar tubercles. In colour it is usually a clearer, less yellowish brown than the smaller forms of *Microtus*. Old and faded museum specimens are often impossible to determine with certainty. The skull is recognizable by its small size, nearly flat dorsal profile, wide interorbital region, and by the almost perpendicular upper incisors. Two geographical forms are known.

PITYMYS SUBTERRANEUS SUBTERRANEUS de Sélys-Longchamps.

1836. *Arvicola subterraneus* de Sélys-Longchamps, Essai Monographique sur les Campagnols des environs de Liége, p. 10 (Waremme, Liége, Belgium).

1845. *H[ypudæus] rufescente-fuscus* Schinz, Synopsis Mamm., II, p. 240 (Urserenthal, Uri, Switzerland). See Mottaz, Bull. Soc. Zool. de France, XX, p. 27, September, 1907.

1845. *H[ypudæus] rufofuscus* Schinz, Synopsis Mamm., II, p. 240 (synomym of *rufescente-fuscus*).

1857. *Arvicola subterraneus* Blasius, Säugethiere Deutschlands, p. 388.

1900. [*Arvicola agrestis*] *fusca* Fatio, Revue Suisse de Zool., VIII, p. 472 (Untervats, Grisons, Switzerland). See Mottaz, Bull. Soc. Zool. de Genève, I, p. 159, November 15, 1908.

1907. *Pitymys subterraneus* Mottaz, Mém. Soc. Zool. de France, XX, p. 27, September, 1907.

1910. *Pitymys subterraneus* Trouessart, Faune Mamm. d'Europe, p. 185.

Type locality.—Waremme, Liége, Belgium.

Geographical distribution.—From Belgium and northern France eastward through Switzerland to Transylvania. Limits of range not well understood.

Diagnosis.—Colour dark and clear; brain-case showing no marked tendency to become unusually broad and flat.

Measurements.—Adult male from the type locality: head and body, 98; tail, 31; hind foot, 14·6; ear, 8. Adult male and female from St. Cergues, Vaud, Switzerland: head and body, 105 and 101; tail, 31 and 32; hind foot, 15 and 15·4. Average and extremes of six adults from Andermatt, Uri, Switzerland: head and body, 97 (94–100); tail, 37·3 (35–39); hind foot, 14·8 (14·6–15). Adult male from St. Moritz, Grisons: head and body, 94; tail, 31·4; hind foot, 14·4; ear, 9. For cranial measurements see Table, p. 761.

Specimens examined.—Seventy-one, from the following localities:—

Belgium: Waremme, Liége, 13 (B.M. and U.S.N.M.); no exact locality, 1 (Lataste).

France: Near Boulogne, Pas-de-Calais, 3; Dinan, Côtes-du-Nord, 1; Étupes, Doubs, 2 (B.M. and Mottaz); Les Lignerets, Orne, 1 (Mottaz).

Switzerland: Near St. Cergues, Vaud, 4 (U.S.N.M. and Mottaz); Bioux, Vaud, 1 (Mottaz); Sengloz, Vaud, 1 (U.S.N.M.); Vidy, near Lausanne, Vaud, 1 (Geneva); Les Plans, Vaud, 1 (Geneva); Andermatt, Uri, 20 (U.S.N.M. and Mottaz); Schellenen, near Göschenen, Uri, 6 (Mottaz); Furka Pass, Uri, 1 (Mottaz); Murgsee Region, St. Gallen, 3 (U.S.N.M. and Mottaz); St. Moritz, Grisons, 2 (Geneva); Poschiavo, Grisons, 1 (Mottaz); Untervats, above Chur, Grisons, 1 (St. Gallen; type of *fusca* Fatio).

Austria-Hungary: Hatszeg, Hunyad, Hungary, 8.

4 & 2 al.	Liége, Belgium.	Baron E. de Sélys-Longchamps (C & P).	37. 1. 3. 170–171, 174–175, 177–178.
4.	Liége. (*de Sélys-Longchamps*).	G. R. Waterhouse (P).	44. 10. 4. 15–18.
2 ♂, 1 ♀.	Boulogne, Pas-de-Calais, France.	O. Thomas (C & P).	98. 1. 9. 21–23.
♂.	Étupes, Doubs. (*C. Mottaz*).	O. Thomas (P).	8. 8. 10. 130.
7 ♂, 1 ♀.	Hatszeg, Hunyad, Transylvania.	C. G. Danford (C).	3. 11. 8. 44–51.

Pitymys subterraneus capucinus Miller.

1908. *Pitymys subterraneus capucinus* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 202, February, 1908.

1910. *Pitymys subterraneus capucinus* Trouessart, Faune Mamm. d'Europe, p. 185.

Type locality.—Spruce forest near "Salon du Capucin," Mont-Dore, Puy-de-Dôme, France. Altitude about 4000 feet.

Geographical distribution.—Known only from the type locality.

Diagnosis.—Similar to *P. subterraneus subterraneus*, but colour not so dark, and skull with brain-case broader and more flattened.

Colour.—General hue of upper parts not so dark as in *P. subterraneus subterraneus*, the exact shade near the mars-brown of Ridgway but with an evident buffy cast; feet a clear, very pale smoke-grey.

Skull and teeth.—In all general features the skull agrees with that of *P. subterraneus subterraneus*, but the brain-case is noticeably broader and more flattened, its length to back of interparietal about equal to breadth over base of zygomata, its lateral rounding off much less evident, and the occipital profile wider in proportion to its depth. Teeth as in the typical form.

Measurements.—Type (adult female): head and body, 102; tail, 33; hind foot, 15. Adult male from the type locality: head and body, 100; hind foot, 15. For cranial measurements see Table, p. 761.

Specimens examined.—Two, both from Mont-Dore.

♀. Mont-Dore, Puy-de-Dôme, France. G. S. Miller (c). 8. 8. 4. 266–267. (8. 8. 4. 267. *Type* of subspecies.)

Pitymys dacius Miller.

1908. *Pitymys dacius* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 202, February, 1908.

1910. *Pitymys dacius* Trouessart, Faune Mamm. d'Europe, p. 188.

Type locality.—Gageni, Prahova, Roumania (at foot of Carpathians, north-west of Bucharest), Roumania.

Geographical distribution.—Known at present from the type locality only.

Diagnosis.—Similar to *Pitymys subterraneus* but skull larger, the nasals more strongly bent downward anteriorly, the brain-case more depressed posteriorly; auditory bullæ larger; posterior upper molar with third inner re-entrant angle very shallow.

Colour.—The colour of the type is indistinguishable from that of typical *P. subterraneus*.

Skull.—In general the skull resembles that of *Pitymys subterraneus*, but the brain-case is more depressed posteriorly and

CRANIAL MEASUREMENTS OF *PITMYS SUBTERRANEUS* AND *P. DACIUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Occipital breadth.	Occipital depth.	Palatal depth.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
P. subterraneus subterraneus.														
Belgium: Waremme, Liége . .	85554		22·4	13·2	3·8	11·0	5·8	6·2	6·0	6·8	14·6	5·4	5·2	
no exact locality .	2189 Lataste	♂	22·0	13·0	3·8	10·8	5·6	6·0	6·0	6·8	13·8	5·2	5·2	
France: near Boulogne, Pas-de-Calais	98. 1. 9. 23	♀	—	—	3·8	11·0	5·2	6·0	—	—	14·8	5·4	5·4	
Switzerland: St. Cergues, Vaud .	124425	♂	22·6	12·8	3·6	10·4	5·8	6·2	6·2	6·8	14·2	5·2	5·2	
Andermatt, Uri .	85692	♂	22·4	13·0	3·8	10·8	5·8	6·0	6·0	6·4	14·0	5·4	5·2	
,, ,, .	85675	♀	23·0	13·2	4·0	11·0	5·8	6·0	6·2	7·0	14·0	5·2	5·4	
,, ,, .	85677	♀	22·2	13·0	3·6	10±	5·8	5·6	6·0	6·6	13·8	5·4	5·4	
,, ,, .	85679	♀	22·0	13·0	3·8	10·2	5·4	5·8	6·0	6·4	14·0	5·2	5·2	
,, ,, .	124584	♀	22·0	13·0	3·6	10·4	5·4	5·6	6·0	6·8	13·8	5·4	5·4	
Göschenen ,, .	1671 Mottaz	♂	23·2	13·2	3·4	11·0	5·8	5·8	6·2	7·2	14·0	5·6	5·4	
,, ,, .	1681 ,,	♂	23·4	13·6	3·4	11·0	5·8	5·8	6·6	7·2	14·0	5·4	5·6	
,, ,, .	1670 ,,	♀	22·0	13·0	3·6	10·6	5·4	5·6	6·0	6·8	13·6	5·2	5·4	
,, ,, .	1682 ,,	♀	23·0	13·4	3·6	11·0	5·6	5·6	6·2	7·0	14·2	5·4	5·4	
Austria-Hungary: Hatszeg, Hunyad	3. 11. 8. 46	♂	22·2	13·0	3·8	10·4	5·4	6·0	5·8	6·6	13·6	5·4	5·4	
,, ,,	3. 11. 8. 47	♂	22·4	13·0	4·0	—	—	5·8	5·8	6·8	14·4	5·4	5·6	
,, ,,	3. 11. 8. 50	♂	22·4±	13·4	3·8	—	—	6·0	6·2	6·8	14·6	5·6	5·6	
P. subterraneus capucinus.														
France: Mont-Dore, Puy-de-Dôme	8. 8. 4. 266	♂	22·6	13·4	3·8	11·0	5·6	5·8	6·2	6·6	14·0	5·4	5·4	
,, ,,	8. 8. 4. 267*	♀	23·4	13·8	3·8	11·2	5·4	6·0	6·4	7·0	14·8	5·8	5·6	
P. dacius.														
Roumania: Gageni . . .	4. 4. 6. 65	♀	23·0	13·6	3·8	10·8	5·0	6·0	5·8	7·0	15·0	5·6	5·8	

* Type.

the nasals are more bent downward in front, the dorsal profile being thus made faintly convex throughout. Though even more flattened than in *P. subterraneus capucinus*, the brain-case is as long relatively to its breadth as in true *subterraneus*. Auditory bullæ larger than in *P. subterraneus* though not peculiar in form.

Teeth. The teeth resemble those of *Pitymys subterraneus*, except that the third inner re-entrant angle of m^3 is so shallow that the terminal loop is essentially straight, its main axis directed backward and slightly outward, its inner border with a short, blunt, projecting point somewhat behind middle.

Measurements.—Type (adult female): head and body, 88; tail, 32·5; hind foot, 14·5; ear, 8·5. For cranial measurements see Table, p. 761.

Specimen examined.—The type.

♀. Gageni, Prahova, Roumania. (*W. Dodson.*) Lord Lilford (p). 4. 4. 6. 65. (*Type* of species.)

PITYMYS DRUENTIUS Miller.

1852. *Arvicola* (*Microtus*) *selysii* Gerbe, Rev. et Mag. de Zool., 2d ser., IV, p. 159, March, 1852 (Near Barcelonnette, Basses-Alpes, France). Not *Arvicola selysii* Bonaparte, 1845.

1911. *Pitymys druentius* Miller, Proc. Biol. Soc., Washington, XXIV, p. 39, February 24, 1911 (Substitute for *selysii*).

Type locality.—Terres-plaines, near Barcelonnette, Basses-Alpes, France.

Geographical distribution.—South-western Alps: limits of range not known.

Diagnosis.—In general similar to *Pitymys subterraneus*, but colour differing in a strong buffy suffusion of the entire pelage, particularly noticeable on ventral surface; feet greyish white in evident contrast with colour of back.

Colour.—Upper parts a light wood-brown, sometimes tinged with raw-umber, faintly grizzled with greyish and black; on sides the wood-brown becomes lighter and more buffy, passing rather abruptly into colour of belly; underparts light ochraceous-buff irregularly darkened by the appearance at surface of slaty under-colour, particularly on chin and throat; feet scantily clothed with silvery greyish white hairs, the dorsal surface of foot strongly contrasted with back; tail obscurely bicolor, brownish above, whitish below.

Skull and teeth.—The skull and teeth resemble those of *Pitymys subterraneus*, but the dorsal profile of the brain-case is somewhat less flattened, and the molars are usually more robust, particularly the posterior maxillary tooth. The terminal loop of this tooth shows a tendency to assume the short, abruptly rounded form characteristic of *P. multiplex*. Inner border of posterior triangle of m^2 with a tendency to develop an evident

convexity, the first stage in the formation of a postero-internal loop. Such an incipient loop rarely if ever occurs in *P. subterraneus*, though it is common and not infrequently well developed in *P. fatioi* and *P. multiplex*.

Measurements.—Average and extremes of six adults from the type locality: head and body, 101·2 (96–105); tail, 33·3 (31–35); hind foot, 14·9 (14·4–15); ear, 9·0 (8·5–9·3). For cranial measurements see Table, p. 766.

Specimens examined.—Eleven, from the following localities in France: neighbourhood of Barcelonnette, Basses-Alpes, 9 (B.M. and U.S.N.M.); Alps of department of Var, 1 (U.S.N.M.); no exact locality, 1.

3.	Basses-Alpes, France.	Purchased (Parzudaki).	52. 5. 27. 53–55.
♂, 3 ♀.	Barcelonnette, Basses-Alpes. (*C. Mottaz.*)	O. Thomas (p).	8. 8. 10. 126–129.

PITYMYS FATIOI Mottaz.

1909. *Pitymys multiplex fatioi* Mottaz, Bull. Soc. Zool. de Genève, 1, p. 180, January 15, 1909. Type in Mottaz collection.
1910. *Pitymys multiplex fatioi* Trouessart, Faune Mamm. d'Europe, p. 189.

Type locality.—Zermatt, Valais, Switzerland.

Geographical distribution.—At present known only from the neighbourhood of Zermatt.

Diagnosis.—Similar to *Pitymys druentius* but larger (hind foot, 15 to 16 mm., condylobasal length of skull about 23 mm.); brain-case less deepened; convexity of dorsal profile very slight; auditory bullæ not specially inflated, scarcely rising to level of cutting surface of molars.

Colour.—The colour does not differ appreciably from that of *Pitymys selysii*.

Measurements.—Average and extremes of seven adults from the type locality: head and body, 99·7 (95–104); tail, 35 (30–39); hind foot, 15·4 (15–16); ear, 9·4 (9–10). For cranial measurements see Table, p. 766.

Specimens examined.—Twenty-six, all from the neighbourhood of Zermatt (U.S.N.M., Mottaz and Geneva).

Remarks.—Though specimens of this animal were included by Fatio under the name *multiplex*, the Zermatt *Pitymys* is, as pointed out by Mottaz, easily distinguishable from the form inhabiting northern Italy and the Italian slope of the Alps. The relationships seem in fact to be much more intimate with the western Alpine *P. druentius;* but more extensive material than that now available will be required before the exact status of the members of this group can be properly understood.

PITYMYS MULTIPLEX Fatio.

1905. [*Arvicola*] *multiplex* Fatio, Arch. Sci. Phys. et Nat., Genève, 4th ser., XIX, p. 193, February 15, 1905 (Lugano, Ticino, Switzerland).

1906. *M*[*icrotus*] *leponticus* Thomas, Ann. and Mag. Nat. Hist., 7th ser., XVII, p. 419, April, 1906 (Locarno, Ticino, Switzerland). Type in British Museum.

1908. *Pitymys multiplex* Mottaz, Bull. Soc. Zool. de Genève, I, p. 165 November 15, 1908.

1910. *Pitymys multiplex* Trouessart, Faune Mamm. d'Europe, p. 189.

Type locality.—Lugano, Ticino, Switzerland.

Geographical distribution.—Italian Switzerland and northern Italy, south to Florence; limits of range not known.

Diagnosis.—Similar to *Pitymys druentius* and *P. fatioi* but decidedly larger (hind foot usually 16 to 17 mm., condylobasal length of skull, 24 to 25 mm.); skull with dorsal profile noticeably convex; auditory bullæ not specially inflated.

External characters.—Ears relatively smaller than in *Pitymys subterraneus*; feet less slender, and both palmar and plantar tubercles sensibly reduced, their relative size approaching that in the members of the *ibericus* group.

Colour.—The colour so nearly resembles that of *Pitymys subterraneus* as to need no detailed description. The dark wash along back tends to be rather extensive, and the entire upper surface is frequently suffused with a light bister or raw-umber. Feet usually with less dusky clouding than in *P. subterraneus*.

Skull.—As compared with that of *Pitymys subterraneus* the skull is throughout larger and more heavily built, though the surface remains equally smooth, and the parietal and temporal ridges are never more than barely indicated. Dorsal profile slightly but evidently convex throughout. Brain-case larger and less depressed than in *P. subterraneus*, the postorbital ridges rather well developed, sometimes with a slightly indicated angular projection, which, however, never becomes so distinct as in the small species of *Microtus*. Length of brain-case to back of interparietal about equal to width over roots of zygomata. Occiput squarely truncate posteriorly, the condyles nearly or entirely hidden when skull is viewed from above. Auditory bullæ of the same relative size as in *P. subterraneus*, but with smoother, more evenly inflated finish.

Teeth.—The teeth resemble in general those of *Pitymys subterraneus*, but the third upper molar is not so long (though still sensibly exceeding the middle tooth) and the posterior portion of its terminal loop is distinctly reduced, the dentine space scarcely as large as that in the first outer triangle, and the incurved enamel portion very short and abruptly hooked, thus distorting the crescentic form of the loop as a whole. Posterior outer triangle usually opening rather widely into terminal loop, though sometimes completely isolated, the exact opposite to the condi-

tion in *P. subterraneus*. Second upper molar showing the maximum of the tendency common to the three related forms, *druentius*, *fatioi* and *multiplex*, for the inner side of third triangle to develop an imperfect postero-internal loop. At least some trace of this tendency may be detected in nearly every specimen, though it is often present in the tooth of one side only. In the most extreme examples that I have seen the supplemental loop is as large as in many specimens of *Microtus agrestis*, though in none is it completely isolated from the outer triangle.

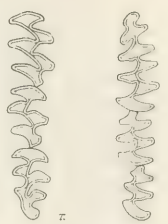

FIG. 157.
Pitymys multiplex.
Enamel pattern. × 5.

Measurements.—Adult male from Gordola, near Locarno, Ticino, Switzerland (type of *leponticus* Thomas): head and body, 95 ; tail, 38 ; hind foot, 16·8 ; ear, 10. Adult female from Locarno, Ticino, Switzerland: head and body, 103 ; tail, 38 ; hind foot, 16·7 ; ear, 10. Adult male from Bellinzona, Ticino, Switzerland: head and body, 100 ; tail, 31 ; hind foot, 17. Adult male from Mirabello, Monferrato, Italy: head and body, 102 ; tail, 33 ; hind foot, 16·5 ; ear, 9. Adult female from Prato, near Genoa, Italy: head and body, 102 ; tail, 35 ; hind foot, 16. Adult female from Borzoli, Genoa, Italy: head and body, 105 ; tail, 27 ; hind foot, 16 ; ear, 10. Adult from Vaccarezza, Italy: head and body, 110 ; tail, 33 ; hind foot, 16·5. For cranial measurements see Table, p. 767.

Specimens examined.—Thirty-nine, from the following localities:—
SWITZERLAND: Near Locarno, Ticino, 5 (including type of *leponticus*); Bellinzona, Ticino, 1; Comano, Ticino, 4 (B.M. and Mottaz); near Lugano, Ticino, 12 (B.M. and Mottaz); Pico Magadino, Ticino, 1 (Ghidini).
ITALY: Porlezza, Como, 3; Domodossola, Novara, 1; Ceresole d'Alba, Turin, 1 (Turin); Mirabello, Monferrato, Alessandria, 1 (Turin); Vaccarezza, 6 (Genoa); Caorsi, Antola, 2; Prato, Genoa, 1 (U.S.N.M.); Borzoli, Genoa, 1; Florence, 1 (U.S.N.M.).

Remarks.—This species was first distinguished by Forsyth Major, who, however, omitted to publish its description. Using the name *leponticus* intended for it by Major, Thomas in 1906 referred to it in his description of the Asia Minor *P. majori*, and thereby became responsible for the name. But in the meantime it had been described by Fatio with a mixture of other forms, its type locality and history being afterwards cleared up in the paper by Mottaz above referred to.

2 ♂, 2 ♀. Locarno, Ticino, Switzerland. O. Thomas (C & P). 5. 8. 2. 11-14. (5. 8. 2. 11. *Type* of *P. leponticus* Thomas.)
♀. Borzoli, Genoa, Italy. Marquis G. Doria (P). 8. 7. 18. 7.

CRANIAL MEASUREMENTS OF *PITMYS DRUENTIUS*, *P. FATIOI* AND *P. MULTIPLEX*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Occipital breadth.	Occipital depth.	Palatal depth.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
P. druentius.														
France: Barcelonnette, Basses-Alpes	153026	♂	—	13·6	3·8	—	—	—	6·2	7·0	14·6	5·8	5·6	
,, ,,	8. 8. 10. 126	♂	23±	13·6	3·8	11·6±	6±	6·2	6·6	7·6	15·0	5·6	5·6	
,, ,,	103347	♀	—	14·0	3·2	—	—	6·4	6·0	6·8	14·6	5·6	5·6	
,, ,,	8. 8. 10. 129	♀	—	—	—	—	—	—	6·2	7·0	15·0	6·0	5·4	
,, ,,	8. 8. 10. 127	♀	23·0	14·0	3·6	11·8	6·0	6·4	6·4	7·4	15·2	5·8	5·4	
,, ,,	8. 8. 10. 128	♀	—	—	—	—	—	—	6·0	7·2	15·0	—	5·6	
Department of Var . .	85526		23·0	—	3·8	12·0	5·4	6·2	5·6	6·8	14·2	5·6	5·4	
P. fatioi.														
Switzerland: Zermatt, Valais . .	124510		22·8	13·8	4·0	11·0	5·6	6·2	6·0	6·8	15·0	5·8	5·8	
,, ,, . .	124511		23·4	14·0	4·0	11·8	6·0	6·6	6·0	7·0	15·2	5·6	5·6	
,, ,, . .	5002 Mottaz	♂	24·2	14·0	3·6	11·0	5·6	6·4	6·4	7·8	15·4	5·8	6·0	Old.
,, ,, . .	5007 ,,		23·4	—	4·0	11±	6±	6·2	6·2	7·2	15·0	5·8	5·6	

P. multiplex.														
Switzerland: Lugano, Ticino . .	1631 Mottaz	♂	24·8	15·0	4·0	12·0	6·0	7·0	6·6	7·8	15·8	6·4	6·2	Old.
,, ,, . .	1630 ,,	♀	24·6	14·8	4·0	12·2	6·0	6·8	6·4	7·4	16·0	6·2	6·0	,,
Locarno ,, . .	5. 8. 2. 11*	♂	24·4	14·4	4·0	12·0	6·0	7·0	6·2	7·0	15·4	6·4	6·2	
,, ,, . .	5. 8. 2. 12	♂	24·0	14·6	4·0	12·0	6·0	7·0	6·2	7·2	15·0	6·2	6·0	
,, ,, . .	5. 8. 2. 13	♀	24·2	14·4	4·0	12·0	6·0	6·8	6·4	7·2	15·6	6·2	6·2	
,, ,, . .	5. 8. 2. 14	♂	24·0	14·4	4·0	11·8	6·0	6·6	6·4	7·4	16·0	6·2	6·0	
Comano ,, . .	115259	♂	24·6	15·0	3·8	12·0	6·0	7·0	6·8	7·4	16·0	6·2	6·2	Old.
Pico Magadino . .	Ghidini	♂	24·8	15·0	4·0	12·4	6·0	7·4	7·0	7·8	16·0	6·4	6·2	
Italy: Bellinzona	,,		24·0	14·4	3·8	11·4	6·0	7·0	6·4	7·8	15·8	6·0	6·0	
Domodossola . . .	—		24·0	14·0	4·0	12·0	6·0	7·0	6·2	7·0	15·0	6·0	6·0	
Caorsi, Antola . . .	90. 3. 5. 11	♂	24·2	14·2	4·0	12·0	6·0	7·0	7·0	7·2	15·4	6·0	6·0	
,, ,, . . .	90. 3. 5. 13	♀	24·0	14·8	4·0	12·0	6·2	7·0	6·4	7·2	15·0	5·8	5·8	
Mirabello, Monferrato . .	Turin	♂	24·4	15·0	4·2	12·6	6·2	7·2	6·6	7·2	15·2	6·0	6·0	
Prato, near Genoa . .	124613	♀	24·4	14·0	4·0	12·0	6·0	7·0	7·0	7·2	15·4	6·0	6·0	
Borzoli ,, . .	8. 7. 18. 7	♀	25·0	15·0	4·0	12·4	6·4	7·0	6·8	7·4	15·4	6·6	6·2	
Florence	105281	♂	24·2	—	4·0	11·8	6·0	6·8	6·2	7·2	15·2	6·0	5·8	

* Type of *leponticus*, Thomas.

PITYMYS SAVII de Sélys-Longchamps.

1838. *Arvicola savii* de Sélys-Longchamps, Revue Zoologique, p. 248, October, 1838.

1845. *A[rvicola] selysii* Bonaparte, Atti della sesta Riunione degli Scienziati Italiani, Milano, 1844, p. 350 (synonym of *savii;* Pecchioli cited as authority).

1857. *Arvicola savii* Blasius, Säugethiere Deutschlands, p. 394.

1908. *Pitymys savii* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 205, February, 1908.

1910. *Pitymys savii* Trouessart, Faune Mamm. d'Europe, p. 187.

Type locality.—Neighbourhood of Pisa, Italy.

Geographical distribution.—Peninsula of Italy from Piedmont southward; apparently occurring for the most part in the plains and lower country.

Diagnosis.—Size and form essentially as in *Pitymys subterraneus*, but feet more robust, ear relatively smaller, and palmar and plantar tubercles more reduced; skull usually more heavily built, much less depressed, the dorsal profile slightly convex, the general appearance much as in *P. multiplex*, except that brain-case is shallower, less elongated and more sub-quadrate; third upper molar about as long as second, normally with three closed triangles, its posterior loop simple, without inner re-entrant angle, its main axis directed backward and slightly outward.

Colour.—The colour resembles that of *Pitymys subterraneus* and *P. multiplex*, but is paler, and seldom, if ever, a clear hair-brown. Upper parts suffused with a light indefinite buffy or very pale wood-brown. Feet whitish grey as in *P. multiplex*, none of the specimens examined showing any trace of the dusky suffusion characteristic of *P. subterraneus*.

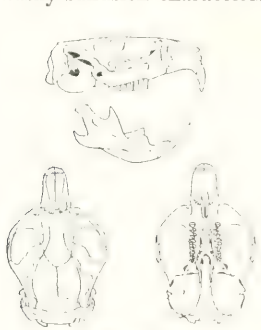

FIG. 158.
Pitymys savii. Nat. size.

Skull.—As compared with that of *P. subterraneus* the skull is broader, more angular (parietal and temporal ridges usually evident, though low) and less depressed, with slightly convex dorsal outline, relatively shorter rostrum, and more squarish, less elongated brain-case (length to back of interparietal slightly less than breadth over roots of zygomata). The zygomata are shorter and more widely projecting. Brain-case squarely truncate posteriorly as in the related species. The palatal aspect of the skull shows no special peculiarities. The skull is smaller than that of *P. multiplex*, and the brain-case is less elongate. The rostrum is also relatively shorter.

Teeth.—Except for the form of the third upper molar the teeth show no peculiarities. This tooth is so shortened that the length of its crown does not exceed that of second molar. It consists of the usual elements, except that the third inner re-entrant angle is lacking and the rather short terminal portion ends posteriorly in a simple elliptical or slightly ovate loop, the main axis of which is directed backward and a little outward. Outer re-entrant angles well developed, sub-equal, the posterior slightly the larger, the second space usually communicating with posterior loop as in *P. multiplex*, both isolated or not from large inner triangle. Second upper molar as in *P. subterraneus*, the third triangle not normally showing any trace of an incipient postero-internal loop.

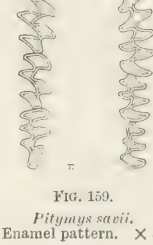

FIG. 159.
Pitymys savii.
Enamel pattern. × 5.

Measurements.—Adult male from Gozzano, Novara, Italy : head and body, 99 ; tail, 27 ; hind foot, 15. Two adult males from Ceresole d'Alba, Turin, Italy : head and body, 96 and 96 ; tail, 25 and 25 ; hind foot, 14·8 and 15·4. Two adult males from Mirabello, Monferrato, Italy : head and body, 97 and 99 ; tail, 24 and 25 ; hind foot, 16 and 16·5 ; ear, 9 and 9. Two adult males from Frugarolo, Alessandria : head and body, 102 and 105 ; tail, 24 and 28 ; hind foot, 15 and 15 ; ear, 9 and 9. Adult male from Parma, Italy : head and body, 99 ; tail, 29 ; hind foot, 16 ; ear, 9. For cranial measurements see Table, p. 774.

Specimens examined.—Ninety-nine, from the following localities :—
ITALY : Gozzano, Novara, 1 (Genoa) ; Milan, 1 ; St. Angelo, Pavia, 3 ; Serravalle, Piedmont, 1 ; Ceresole d'Alba, Turin, 5 (Turin) ; Frugarolo, Alessandria, 21 (B.M., Genoa, and Mottaz) ; Mirabello, Monferrato, Alessandria, 2 (Turin) ; Caorsi, Mount Antola, 3 ; Modena, 3 ; Pisa, 1 (Mottaz) ; Florence, 29 (U.S.N.M. and Mottaz) ; Urbino, Marche, 3 ; Benagna, Perugia, 1 (Genoa) ; Ostia, Rome, 1 ; Chieuti, Foggia, 24 (B.M. and Genoa).

1.	Milan, Italy.	Baron E. de Sélys-Longchamps (P).	45. 7. 5. 10.
♂, 2 ♀ al.	St. Angelo, Pavia.	Marquis G. Doria (P).	90. 4. 7. 3–5.
♀ al.	Serravalle, Piedmont.	Marquis G. Doria (P).	90. 3. 5. 10.
2 ♂, 2 ♀, 2 al.	Frugarolo, Alessandria.	Marquis G. Doria (P).	7. 1. 9. 10–15.
♂.	Mirabello, Alessandria.	Dr. E. Festa (P).	8. 8. 1. 5.
♂, 2 ♀ al.	Caorsi, Liguria.	Marquis G. Doria (P).	90. 3. 5. 11–13.
♂, ♀, ♀ juv al.	Modena.	Marquis G. Doria (P).	90. 3. 5. 4–6.
2 ♀, juv al.	Urbino, Marche.	Marquis G. Doria (P).	90. 3. 5. 7– 9.
1.	Ostia, Rome.	Dr. L. Sambon (C & P).	1. 1. 2. 10.
2 ♂, ♀.	Chieuti, Foggia.	Genoa Museum (E).	8. 7. 18. 6. 8. 8. 2. 1–2.

PITYMYS NEBRODENSIS Minà-Palumbo.

1868. *Arvicola nebrodensis* Minà-Palumbo, Ann. Agric. Sicil., XII, p. 61.
1910. *Pitymys savii nebrodensis* Trouessart, Faune Mamm. d'Europe, p. 187.

Type locality.—Le Madonie, Sicily.

Geographical distribution.—Sicily.

Diagnosis.—Similar to *Pitymys savii*, but skull with deeper, more elongate, less flattened brain-case, and more evidently convex dorsal profile; mesopterygoid space relatively wider than in *P. savii*.

Colour.—The colour does not differ appreciably from that of the related species.

Skull.—The general form of the skull as viewed from above is much as in *Pitymys savii*; length of brain-case about equal to breadth over roots of zygomata. In lateral and posterior view, however, it is seen to be decidedly deeper, more as in ordinary members of the *ibericus* group.

Teeth.—The teeth are essentially as in *Pitymys savii*, though the posterior upper molar is usually not so long owing to the excessive shortening of the posterior loop. In one specimen* among the ten skulls examined, the first outer triangle is opposite the inner triangle, the two together forming a single transverse loop as in the *ibericus* group. The length of the outer triangle is, however, not reduced, so that the resemblance to *ibericus* is only superficial.

Measurements.—Adult male from Castelbuono, Sicily: head and body, 100; tail, 29; hind foot, 16; ear, 10. For cranial measurements see Table, p. 774.

Specimens examined.—Nine, all from the island of Sicily (B.M. and U.S.N.M.).

♂, ♀.	Palermo, Sicily.	J. I. S. Whitaker (P).	98. 10. 6. 16–17.
3 ♂, 1 ♀.	Castelbuono. (*A. Robert.*)	O. Thomas (P).	6. 8. 4. 45–46. 8. 9. 1. 26–27.
♂ al.	Madonie.	Marquis G. Doria (P).	90. 3. 5. 14.

PITYMYS PYRENAICUS de Sélys-Longchamps.

(Synonymy under subspecies.)

Geographical distribution.—Pyrenees (known from the French side only) and region to the north as far as the Garonne. Limits of range not known.

Diagnosis.—Related to *Pitymys savii* and *P. nebrodensis*; general form of skull somewhat intermediate between that of the Italian and Sicilian species, but mesopterygoid fossa decidedly narrower.

* ♂. No. 98. 10. 6. 16, Palermo, Sicily.

Skull.—The skull has much the same general outline as in *P. nebrodensis*, that is, the brain-case is slightly longer than broad and the dorsal profile is slightly convex, but the depth is about as in *P. savii* and *P. multiplex*. It is readily distinguished from that of *P. subterraneus* by its much less flattened brain-case and by the evidently convex dorsal profile. Palate with lateral pits unusually shallow and ill-defined.

Teeth.—As in *Pitymys savii*. In one otherwise normal specimen* the terminal loop of the last upper molar is cut by a deep inner re-entrant angle.

PITYMYS PYRENAICUS PYRENAICUS de Sélys-Longchamps.

1847. *A[rvicola] pyrenaicus* de Sélys-Longchamps, Revue Zoologique, p. 305, October, 1847.

1908. *Pitymys pyrenaicus pyrenaicus* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 203, February, 1908.

1910. *Pitymys pyrenaicus* Trouessart, Faune Mamm. d'Europe, p. 189.

Type locality.—Bagnères de Bigorre, Hautes-Pyrénées, France.

Geographical distribution.—Pyrenees (not known from the Spanish side).

Diagnosis.—General colour above a nearly clear hair-brown as in *P. subterraneus*.

Measurements.—Adult female from l'Hospitalet, Ariège: head and body, 104; tail, 34; hind foot, 16; ear, 8. Adult male and female from Ax-les-Thermes, Ariège: head and body, 101 and 97; tail, 33·4 and 29·6; hind foot, 15·8 and 15·4. Two adult males from Barèges, Hautes-Pyrénées: head and body, 94 and 96; tail, 32 and 32; hind foot, 15·8 and 16; ear, 8·6 and 8·2. For cranial measurements see Table, p. 775.

Specimens examined.—Thirteen, from the following localities:—
FRANCE: L'Hospitalet, Ariège, 2; Ax-les-Thermes, Ariège, 3; Luchon, Haute-Garonne, 1; Barèges, Hautes-Pyrénées, 5; Pyrenees, no exact locality, 2.

♀. L'Hospitalet, Ariège, France.	G. S. Miller (C).	8. 8. 4. 272.
2 ♂. Ax-les-Thermes, Ariège.	G. S. Miller (C).	8. 8. 4. 268–269.
♂. Luchon, Haute-Garonne. (*A. Robert.*)	O. Thomas (P).	6. 4. 1. 78.
2 ♂. Barèges, Hautes-Pyrénées.	G. S. Miller (C).	8. 8. 4. 270–271.
1. Pyrenees.	Baron E. de Sélys-Longchamps (P).	45. 7. 5. 6.
1. Pyrenees.	Purchased (Parzudaki).	56. 3. 12. 6.

* ♂. No. 8. 8. 4. 271, Barèges, Hautes-Pyrénées, France.

Pitymys pyrenaicus brunneus Miller.

1908. *Pitymys pyrenaicus brunneus* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 203, February, 1908. Type in British Museum.
1910. *Pitymys pyrenaicus brunneus* Trouessart, Faune Mamm. d'Europe, p. 189.

Type locality.—Forest of Bouconne, Gers, France.

Geographical distribution.—Lowlands of south-western France from near base of Pyrenees to the Garonne. Limits of distribution not known.

Diagnosis.—Like *Pitymys pyrenaïcus pyrenaicus*, but colour of upper parts with a decided cast of buffy or pale wood-brown, much as in *P. savii*.

Measurements.—Type (adult female): head and body, 93; tail, 26; hind foot, 15; ear, 8. Average and extremes of five adults from the type locality: head and body, 96 (93–104); tail, 25·6 (23–29); hind foot, 15·4 (15–16); ear, 7·7 (7–9). For cranial measurements see Table, p. 775.

Specimens examined.—Fifteen, from the following localities in south-western France: Forest of Bouconne, Gers, 14; Cadillac, Gironde, 1 (U.S.N.M.).

4 ♂, 3 ♀. Forêt de Bouconne, Gers, France. (*A. Robert.*) O. Thomas (p). 6. 4. 1. 79–85. (6. 4. 1. 82. *Type* of subspecies.)

PITYMYS PLANICEPS Miller.

1908. *Pitymys planiceps* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 203, February, 1908. Type in Lataste Collection.
1910. *Pitymys planiceps* Trouessart, Faune Mamm. d'Europe, p. 190.

Type locality.—Barèges, Hautes-Pyrénées, France.

Geographical distribution.—Known only from the type locality.

Diagnosis.—Size about as in *Pitymys subterraneus* (condylobasal length of skull, 23 mm.); skull more flattened and depressed than in any other known European member of the genus, the dorsal profile nearly straight from posterior extremity of nasals to back of interparietal; teeth as in *P. savii* and *P. pyrenaicus*. External characters not known.

Skull and teeth.—In general outline as viewed from above the skull resembles that of *Pitymys savii* in its rather short rostrum, broadly spreading zygomatic arches and squarish brain-case (length to back of interparietal equal to breadth over zygomatic roots). Laterally and posteriorly it suggests *P. subterraneus*, but with the normal characters of the species carried to the extreme. The dorsal profile is essentially straight from posterior extremity of nasals to back of interparietal, though there is a faint concavity in interorbital region and a slight convexity at middle of brain-case. Interorbital region about as

in *P. savii*, the temporal ridges wide apart and barely perceptible. Auditory bullæ rather larger than usual in *P. subterraneus* and more smoothly inflated. As compared with that of *P. pyrenaicus* the skull is immediately recognizable by its flat dorsal profile and short, broad, excessively flattened brain-case. Teeth as in *Pitymys pyrenaicus*.

Measurements.—External measurements not known. For cranial measurements see Table, p. 775.

Specimen examined.—The type.

PITYMYS GERBII Gerbe.

1879. *Arvicola* (*Microtus*) *gerbii* Gerbe, Le Naturaliste, I, p. 51, July 1, 1879.

1880. *Arvicola* (*Microtus*) *gerbei* Gerbe, Bull. Soc. Zool. de France, Paris, V, p. 49, pl. IV, figs. 1–9.

1910. *Pitymys gerbei* Trouessart, Faune Mamm. d'Europe, p. 186.

Type locality.—Dréneuf, Loire-Inférieure, France.

Geographical distribution.—Known only from the type locality.

Diagnosis.—In general like *Pitymys savii* and *P. pyrenaicus*, but skull somewhat heavier, and interparietal lozenge-shaped, narrowed at outer extremity to an acute point which usually does not come in contact with temporal; m^3 with crown decidedly shorter than that of m^2, its first outer triangle opening broadly into inner triangle.

External characters and colour.—Apparently about as in *P. pyrenaicus*, so far as can be determined from a somewhat faded mounted specimen.

Skull.—The skull differs from that of *Pitymys pyrenaicus* in greater relative depth and breadth throughout, shorter, heavier rostrum, shorter incisive foramina, wider interorbital region, and in the very peculiar form of the interparietal, as already described; nasals conspicuously angular-emarginate posteriorly; auditory bullæ rather large.

Teeth.—The teeth do not differ from those of *Pitymys pyrenaicus* except that the third upper molar is shorter and its first outer triangle opens broadly into inner triangle, a condition more usual in members of the *ibericus* group.

Measurements.—The following measurements are given by Gerbe: head and body, 94–95; tail, 27–28; hind foot (c. u.) 17. For cranial measurements see Table, p. 775.

Specimen examined.—One from Dréneuf (paratype) in Paris Museum.

Remarks.—This species is well characterized by the great general breadth of skull, unusually wide interorbital region, and very peculiar interparietal. The last character might be supposed to be an accidental variation or abormality were it not

CRANIAL MEASUREMENTS OF *PITYMYS SAVII*, *P. NEBRODENSIS*, *P. PYRENAICUS*, *P. PLANICEPS* AND *P. GERBII*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Occipital breadth.	Occipital depth.	Palatal depth.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
P. savii.														
Italy: Piedmont	37932	♂	23·2	14·8	3·8	11·4	5·6	6·6	6·0	7·2	15·4	5·8	6·0	
Alessandria	542 Mottaz	♂	23·0	14·0	3·8	11·0	6·0	6·6	6·0	7·0	14·0	5·4	5·4	
,,	7. 1. 9. 10	♂	23·2	14·2	3·8	11·8	5·8	6·6	6·6	7·4	15·0	5·6	5·6	Old.
,,	7. 1. 9. 11	♂	23·2	14·6	3·6	11·6	6·0	6·6	6·4	7·4	15·0	5·6	5·6	,,
,,	7. 1. 9. 13	♀	22·8	14·2	4·0	11·4	5·8	6·6	6·0	7·0	14·4	5·4	5·4	Young adult.
,,	541 Mottaz	♀	23·6	14·8	3·4	11·2	5·8	6·8	6·2	7·4	15·0	5·8	5·8	Old.
Pavia	90. 4. 7. 5	♀	23·0	14·0	3·6	11·0	5·4	6·4	6·0	7·0	14·8	5·4	5·4	
Mirabello	Festa 13	♂	23·2	14·4	3·8	11·8	6·0	6·8	6·0	7·2	14·8	5·8	6·0	Old.
,,	8. 8. 1. 5	♂	24·0	15·0	3·8	12·2	6·2	7·2	6·2	7·6	15·6	5·8	6·0	Fully adult.
Modena	No. 1	♀	23·6	14·4	3·6	10·0	5·6	6·6	6·0	7·2	15·2	5·6	5·6	
Florence	2613 Mottaz	♀	23·0	14·0	3·6	11·6	5·8	6·6	6·2	7·2	14·4	5·4	5·8	
Ostia	1. 1. 2. 10		24·0	14·6	3·8	11·4	6·0	6·6	6·2	7·2	15·2	5·6	5·4	
P. nebrodensis.														
Sicily: Castelbuono	8. 9. 1. 27	♂	24·0	14·0	3·8	11·6	6·2	8·0	6·2	7·6	15·4	5·8	6·0	
San Giuglielmo	6. 8. 4. 46	♀	23·0	13·8	3·6	11·4	6·0	7·2	6·0	7·2	15·2	5·8	6·0	

P. pyrenaicus pyrenaicus.													
France: Ax-les-Thermes, Ariège .	8. 8. 4. 269	♂	23·8	14·4	4·0	12·0	6·0	7·0	6·8	7·2	15·2	5·8	5·6
,, ,, .	8. 8. 4. 272	♀	24·0	13·8	3·8	11·4	5·8	6·8	6·4	7·2	15·2	5·8	5·8
,, ,, .	172171	♀	24·0	14·0	4·0	11·8	6·0	6·6	6·8	7·2	15·4	6·0	6·0
Barèges, Hautes-Pyrénées	172174	♂	23·0	13·8	3·8	11·4	6·0	6·8	6·2	7·0	15·0	5·6	5·6
,, ,,	8. 8. 4. 271	♂	23·4	13·8	3·8	11·2	6·0	6·6	6·4	7·0	15·0	5·6	5·6
,, ,,	3345 Lataste		24·0	14·2	3·6	12·0	—	6·8	6·6	7·4	15·4	5·6	5·8
P. pyrenaicus brunneus.													
France: Bouconne, Gers . .	6. 4. 1. 82*	♀	23·0	14·0	4·0	11·0	5·6	6·2	6·0	7·0	15·0	5·8	5·8
,, ,, . .	105733	♀	23·6	14·0	4·0	11·4	5·8	6·8	6·6	7·2	15·2	5·6	5·6
,, ,, . .	105739	♀	23·0	14·2	4·0	11·6	5·4	6·8	6·2	7·0	14·8	5·8	5·6
P. planiceps.													
France: Barèges, Hautes-Pyrénées	2190* Lataste		23·0	14·0	3·8	11·4	5·4	6·2	6·0	7·0	14·6	5·6	5·6
P. gerbii.													
France: Dréneuf, Loire-Inférieure	Paris		24±	14·0	4·2	11·4	—	6·8	6·2	7·2	15·0	5·4	5·6

* Type.

present in the Paris specimen* as well as in the eleven skulls examined by Gerbe. No approach to this form of interparietal has been seen in other members of the *savii* group, though it is sometimes approximated in *ibericus* and its allies. The depth of skull relatively to its length is intermediate between that of *P. pyrenaicus* and *P. ibericus*.

PITYMYS LUSITANICUS Gerbe.

1879. *Arvicola* (*Microtus*) *lusitanicus* Gerbe, Rev. et Mag. de Zool., 3rd ser., VII, p. 44.

1905. *Microtus* (*Pitymys*) *lusitanicus* Major, Ann. and Mag. Nat. Hist., 7th ser., XV, p. 512, May, 1905.

1908. *P*[*itymys*] *lusitanicus* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 204, February, 1908.

1910. *Pitymys lusitanicus* Trouessart, Faune Mamm. d'Europe, p. 193.

Type locality.—Portugal.

Geographical distribution.—Portugal; limits of range unknown.

Diagnosis.—Size small (hind foot, 14·5 to 15·5 mm.; condylobasal length of skull, 22·6 to 23 mm.); skull slender and lightly built, not depressed, the dorsal profile convex throughout; brain-case high and rounded, its depth, including auditory bulla, about 74 per cent of occipital breadth; third upper molar scarcely as long as second, normally without closed triangles, its posterior loop short, simple, without inner re-entrant angle, directed backward and slightly outward; upper incisors rather strongly projecting; colour dark.

Colour.—The colour is essentially as in *Pitymys subterraneus*, except that the underparts are a less clear grey. Upper parts a dark hair-brown tinged with bister or sepia, and very faintly grizzled by black tips and light reflections. Underparts a dull buffy grey, in some specimens becoming almost a dull ochraceous buff on cheeks and on sides along border of dark area; feet buffy grey without dusky wash; tail obscurely bicolor, buffy white below, dusky mixed with buffy white above.

Skull.—The skull very closely resembles that of *Pitymys nebrodensis*. Dorsal profile convex throughout, or somewhat flattened in interorbital region. Interorbital constriction wider than anterior portion of rostrum, flat or slightly concave laterally, the outer edges marked by faint ridges in extreme old age, these ridges rarely extended back across parietals. Brain-case high, strongly rounded off at sides, its length to back of interparietal about equal to breadth over zygomatic roots. Posteriorly the

* Though presented by Gerbe this specimen is not likely to be one of those whose cranial peculiarities were mentioned by the describer of the species. It was originally mounted with the skull inside, and the nose and upper lips were found to be attached to the rostrum when the skull was removed for my examination, through Dr. Trouessart's kindness, in 1908.

brain-case is less squarely truncate than in *P. nebrodensis* or *P. subterraneus*, so that the condyles are usually visible when skull is viewed from above. Auditory bullæ rather small, their surface smoothly rounded. Palate with lateral pits large and sharply defined, noticeably wider than median ridge.

*Teeth.**—Though resembling in a general way those of *Pitymys savii* the teeth are at once recognizable by the size and position of the anterior outer triangle of m^3. This triangle is so reduced in size that it is smaller than the succeeding triangle, and its point does not reach the level of a line joining the outer extremity of the anterior loop with tip of second outer triangle. In position the first outer triangle is opposite the large inner triangle, the two communicating freely by their bases, and together forming a single transverse loop varying somewhat in form according to the completeness of fusing of the two triangles. The second outer triangle never communicates with the loop thus formed, but usually opens into the terminal loop as in *P. savii*. Terminal loop short and broad, without trace of inner re-entrant angle, its main axis directed backward and slightly outward. The length of the third tooth is noticeably less than that of the second, and the shortness of the first outer triangle often causes the crown to assume a peculiar outward-bowed general outline that is highly characteristic of the members of the group. Second upper molar as in *P. subterraneus*, the third triangle without trace of postero-internal loop. Upper incisors slightly projecting, most of their anterior surface visible when skull is viewed from above, but not sufficiently thrown forward to be a conspicuous feature. Other teeth without special peculiarities.

Measurements.—Average and extremes of seven adults from Cintra, Portugal: head and body, 93·2 (90–98); tail, 23·4 (21–27); hind foot, 15 (14·5–15·7); ear, 8·3 (8–8·6). For cranial measurements see Table, p. 788.

Specimens examined.—Eighteen, all from Cintra, Portugal.

7 ♂ 7 ♀, 2 al. Cintra, Portugal. O. Thomas (c & r). 98. 2. 2. 37–52.

PITYMYS MARIÆ Major.

1905. *Microtus* (*Pitymys*) *mariæ* Major, Ann. and Mag. Nat. Hist., 7th ser., xv, p. 515, May, 1905. Type in British Museum.

1908. *P*[*itymys*] *mariæ* Miller, Ann. and Mag. Nat. Hist., 8th ser., i, p. 204, February, 1908.

1910. *Pitymys mariæ* Trouessart, Faune Mamm. d'Europe, p. 192.

Type locality.—Villalba, Lugo, Galicia, Spain.

Geographical distribution.—Known at present from the type locality only.

* Essentially similar to those of *P. ibericus*, fig. 162 (p. 781).

Diagnosis.—Similar to *Pitymys lusitanicus*, but skull with narrower, lower brain-case; upper incisors so slightly projecting as to be scarcely visible when skull is viewed from above.

Colour.—The colour is probably similar to that of *Pitymys lusitanicus*, though in the only known specimens, skinned after immersion in alcohol, it has a peculiar, perhaps unnatural russet cast.

Skull.—General outline of skull when viewed from above essentially as in *Pitymys subterraneus*, the length of brain-case to back of interparietal evidently more than width over zygomatic roots. Whole skull more depressed than that of *P. lusitanicus*, so that dorsal profile is much less convex, and general outline viewed from the side is less strongly cuneate. Auditory bullæ and structure of palate as in *P. lusitanicus*.

Teeth.—As in *Pitymys lusitanicus*, but upper incisors nearly vertical, so that part of the anterior surface of teeth is invisible when skull is viewed from above.

Measurements.—Type (adult female): head and body, 79; tail, 30; hind foot, 13·6; ear, 76. Not fully adult male from the type locality: head and body, 84; tail, 25; hind foot, 14; ear, 7·5. For cranial measurements see Table, p. 788.

Specimens examined.—Eight, all from north-western Spain.

2 ♂, 6 al. Villalba, Lugo, N.W. Spain. Dr. V. L. Seoane (C & P). 94. 1. 1. 16–17. (94. 1. 1. 16. *Type* of species.)

PITYMYS PELANDONIUS Miller.

1908. *Pitymys pelandonius* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 204, February, 1908. Type in British Museum.

1910. *Pitymys pelandonius* Trouessart, Faune Mamm. d'Europe, p. 192.

Type locality.—Silos, Province of Burgos, Spain. Altitude about 3000 feet.

Geographical distribution.—Not known at present elsewhere than in the neighbourhood of the type locality.*

Diagnosis.—Similar to *Pitymys mariæ* Major, but skull with broader, less elongated brain-case.

Colour.—The colour of the four skins examined resembles that of the lighter, more wood-brown specimens of *P. lusitanicus*.

Skull and teeth.—The skull differs from that of both *Pitymys lusitanicus* and *P. mariæ* in its broader more quadrate brain-case. Posteriorly the brain case is rather low, as in *P. mariæ*, though much less reduced in depth than that of *P. depressus*. Teeth as in *P. mariæ*, the upper incisors nearly vertical.

Measurements.—Type (adult female): head and body, 96; tail, 28; hind foot, 14·4; ear, 8·4. Adult female from Castrillo

* Occurs among brush and shrubbery, avoiding the open fields inhabited by *P. ibericus*.

de la Reina, Burgos: head and body, 92; tail, 22·4; hind foot, 14·4; ear, 8. For cranial measurements see Table, p. 788.

Specimens examined.—Four, from the following localities in Spain: Silos, Burgos, 3 (B.M. and Mottaz); Castrillo de la Reina, Burgos, 1.

2 ♀. Silos, Burgos, Spain. G. S. Miller (c). 8. 8. 4. 294–295. (8. 8. 4. 294. *Type* of species.)

PITYMYS DEPRESSUS Miller.

1908. *Pitymys depressus* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 204, February, 1908. Type in British Museum.
1910. *Pitymys depressus* Trouessart, Faune Mamm. d'Europe, p. 193.

Type locality.—Rascafria, south side of Sierra de Guadarrama, Province of Madrid, Spain.

Geographical distribution.—Central Spain; at present known from the region of the Sierra de Guadarrama only.

Diagnosis.—A small animal related to *Pitymys mariæ* and *P. pelandonius*, but immediately recognizable by its broadened, much flattened skull, and very small auditory bullæ.

Colour.—The colour is apparently similar to that of *Pitymys lusitanicus* and *P. pelandonius*, but the only known specimens have been preserved in alcohol and may not now be in normal condition.

Skull.—The skull differs conspicuously from that of the other known members of the *ibericus* group, all of which, *P. mariæ* and *P. pelandonius* not excepted, are characterized by depth of brain-case, in the much flattened general form, the outline, viewed from the side, not very unlike that of *P. savii*. Dorsal profile slightly but evidently and very evenly convex, the nasals not so abruptly sloping as usual. Rostrum excessively shallow immediately behind incisors, its least vertical depth barely exceeding greatest combined breadth of nasals. Posterior termination of nasals straight or slightly emarginate, exceeded by nasal branch of premaxillary to extent of nearly 1 mm. Interorbital region about as wide as anterior portion of rostrum, faintly concave laterally, the temporal ridges evident in adults, though very low and always remaining wide apart. Zygomata rather noticeably expanded at middle, projecting conspicuously beyond level of sides of brain-case. Length of brain-case to posterior edge of interparietal less than breadth over roots of zygomata, the general outline sub-circular; occipital

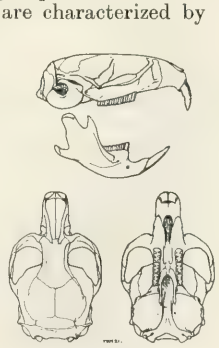

FIG. 160.
Pitymys depressus.
Nat. size.

region obliquely truncate posteriorly, so that condyles are plainly visible when skull is viewed from above, very low and wide in posterior aspect; postorbital ridges low but evident, slightly angled; temporal ridges continued back across frontal and parietal to outer edge of interparietal, abruptly angled at middle of parietal. Auditory bullæ very small and low, their greatest diameter contained about four times in condylobasal length of skull (about 3 to 3½ times in *lusitanicus*, *mariæ*, and *pelandonius*), their surface rather smoothly inflated. Palate with well-defined grooves and rather shallow lateral pits exceeding in breadth the flattened median ridge.

Teeth.—The teeth show no peculiarities as compared with those of other members of the group.

Measurements.—Type (adult female): head and body, 85; tail, 25; hind foot, 13; ear, 8. Two adult females from the type locality: head and body, 85 and 93; tail, 29 and 23; hind foot, 14 and 14; ear, 7·5 and 8. For cranial measurements see Table, p. 788.

Specimens examined.—Thirteen, from the following localities in Spain: La Granja, Segovia, 6; Rascafria, Madrid, 6; Villalba, Madrid, 1.

6 al.	La Granja, Segovia, Spain.	M. de la Escalera (c).	8. 7. 30. 9–14.
♀ & 5 al.	Rascafria, Madrid.	M. de la Escalera (c).	6. 11. 4. 10–15. (6. 11. 4. 15. *Type* of species.)
♀.	Villalba, Madrid. (*N. Gonzalez*).	O. Thomas (p).	8. 2. 9. 212.

PITYMYS IBERICUS Gerbe.

(Synonymy under subspecies.)

Geographical distribution. Probably the entire Iberian Peninsula, though at present known only from central and southern Spain.

Diagnosis.—Larger than *Pitymys lusitanicus* and its allies (hind foot, 15 to 18·4 mm., condylobasal length of skull, 24 to 25 mm. or more), and adaptation to underground life more complete; skull with brain-case less evidently parallel-sided, its outline in many individuals almost sub-orbicular; upper incisors long, conspicuously protruding, nearly their entire front face visible when skull is viewed from above; colour usually rather pale, ranging from hair-brown to a light buffy drab. Habits strictly subterranean.

External characters.—General form differing rather conspicuously from that of *Pitymys subterraneus* and *Microtus arvalis* in its much more evident adaptation to underground life, the head large, with incisors noticeably protruding from mouth, the neck short and thick; ears much reduced, almost hidden in the fur; feet strong and robust, the hind foot shortened and broadened, the digits and claws of both front and hind feet

thickened, palmar and plantar tubercles somewhat reduced in size, crowded into a relatively smaller area than in *P. subterraneus*; tail short, scarcely more than one-quarter as long as head and body.

Colour.—Upper parts a peculiar drabby grey, varying considerably in exact shade as described under the subspecies, the sides often with a noticeable buffy tinge; underparts and feet whitish in rather marked contrast with back; tail whitish, the upper surface usually clouded with brown.

Skull.—The skull resembles that of *Pitymys lusitanicus*, but its general size is greater, the zygomata are more abruptly spreading, the brain-case is relatively shorter and deeper, and the occiput is more obliquely truncate, so that condyles are more plainly visible when skull is viewed from above. Depth of rostrum immediately behind incisors about equal to width in same region. Interorbital constriction about as wide as anterior portion of rostrum, its dorsal surface convex laterally; temporal ridges low and indistinct, scarcely visible except in rather old individuals, sometimes rather closely approaching each other, though without coalescing, and seldom if ever extending back over parietals. Length of brain-case about equal to or slightly less than width across zygomatic roots, the outline when viewed from above sub-quadrate or occasionally almost circular; postorbital ridges low but attaining a fair degree of development in old age, never, however, strongly angled. Auditory bullæ well developed, smooth, their greatest diameter contained about three and a half times in condylobasal length of skull. Palate showing no special peculiarities. Incisive foramina as usual in the genus, their longitudinal diameter about equal to one-half distance from gnathion to alveolus of first molar.

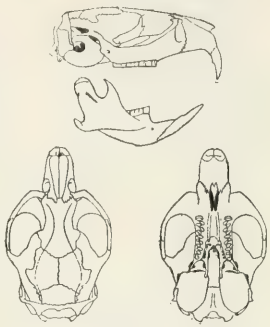

FIG. 161.

Pitymys ibericus. Nat. size.

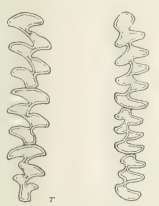

FIG. 162.

Pitymys ibericus.
Enamel pattern. × 5.

Teeth.—The teeth of *Pitymys ibericus* so exactly resemble those of *P. lusitanicus* as to need no detailed description. They are, however, larger throughout, and the upper incisors project more strongly forward, so that practically the entire front face is visible when skull is viewed from above.

Pitymys ibericus ibericus Gerbe.

1854. *Arvicola ibericus* Gerbe, Revue Zoologique, 1854, p. 400. Type in Paris Museum.
1879. *Arvicola* (*Microtus*) *ibericus* Gerbe, Rev. et Mag. de Zool., 3rd ser., VII, p. 42.
1905. *Microtus ibericus* Major, Ann. and Mag. Nat. Hist., 7th ser., XV, p. 515, May, 1905.
1908. *Pitymys ibericus ibericus* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 205, February, 1908.
1910. *Pitymys ibericus* Trouessart, Faune Mamm. d'Europe, p. 190.

Type locality.—Province of Murcia, Spain.

Geographical distribution.—Coast region of south-eastern Spain (Provinces of Alicante, Murcia and eastern portion of Granada).

Diagnosis.—Size large (hind foot, usually 17·6 to 18·4 mm.; upper tooth-row, 6 to 6·4 mm.); general colour very pale.

Colour.—Upper parts ranging from a pale hair-brown slightly tinged with bister along middle of back and suffused with buffy along sides to a light, buffy broccoli-brown, brightening nearly to cream-buff on flanks and on sides of neck. Underparts usually greyish white dulled by the slaty undercolour, the general effect not far from the grey No. 9 of Ridgway, but occasionally washed with buffy. Feet clear greyish white. Tail whitish with a varying amount of dark brown along median dorsal region, this brown occasionally almost absent.

Measurements.—Type (adult): head and body, 114 (skin); tail, 26; hind foot, 18. Adult female from Venta del Baul, Granada, Spain: head and body, 107; tail, 27; hind foot, 18; ear, 8. Three adult females from Elche, Alicante, Spain: head and body, 101, 105 and 106; tail, 27, 27 and 29; hind foot, 17·6, 18 and 18·4. For cranial measurements see Table, p. 789.

Specimens examined.—Eleven, from the following localities in Spain: Venta del Baul, Granada, 3; Murcia, no exact locality, 1 (Paris; type); Elche, Alicante, 7.

♂, 2 ♀.	Elche, Alicante, Spain. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 209–211.
3 ♀.	Elche, Alicante.	G. S. Miller (C).	8. 8. 4. 273–275.
♂, ♀.	Venta del Baul, Granada.	G. S. Miller (C).	8. 8. 4. 276–277.

Pitymys ibericus centralis Miller.

1908. *Pitymys ibericus centralis* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 205, February, 1908. Type in British Museum.
1910. *Pitymys ibericus centralis* Trouessart, Faune Mamm. d'Europe, p. 190.

Type locality.—Pastures near Silos, Province of Burgos, Spain. Altitude about 3000 feet.

Geographical distribution.—Central Spain from the province of Burgos south to Valencia and Seville; exact limits of range not known.

Diagnosis.—Not so large as *P. ibericus ibericus* (hind foot, 16 to 17·2 instead of 17·6 to 18·4); colour hair-brown usually tinged with buffy, never with the pallid tints characteristic of the typical race; feet whitish in rather noticeable contrast with back.

Measurements.—Type (adult male): head and body, 102; tail, 24; hind foot, 16·8; ear, 8. Average and extremes of ten adults from the type locality: head and body, 99 (95–103); tail, 25·9 (24–28); hind foot, 16·6 (16–17·2); ear, 8·4 (8–9). Adult male from Catarroja, Valencia: head and body, 100; tail, 21; hind foot, 16; ear, 9. Three adults from Seville: hind foot (dry), 16, 16 and 16·6. For cranial measurements see Table, p. 789.

Specimens examined.—Sixty, from the following localities in Spain: Silos, Burgos, 27; near Burgos, 3; Catarroja, Valencia, 1; near Seville, 22 (B.M. and U.S.N.M.); Jerez de la Frontera, Cadiz, 5 (perhaps referable to *P. ibericus regulus*); Coto Doñana, Huelva, 2.

8 ♂, 2 ♀.	Silos, Burgos, Spain.	G. S. Miller (C).	8. 8. 4. 278–287. (8. 8. 4. 278. *Type* of subspecies.)
1 al.	Burgos.	N. Gonzalez (C).	8. 7. 7. 45.
♂.	Catarroja, Valencia. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 208.
6 ♂, 4 ♀, 2 juv.	Seville. (*A. Ruiz.*)	Lord Lilford (P).	95. 3. 3. 29–40.
2 al.	Jerez de la Frontera, Cadiz.	Abel Chapman (C & P).	0. 5. 10. 2–3.
2 al.	Jerez de la Frontera, Cadiz.	A. Trevor Battye (C & P).	7. 9. 12. 1–2.
1.	Jerez de la Frontera, Cadiz.	Abel Chapman (C & P).	8. 3. 26. 6.
2.	Coto Doñana, Huelva.	Abel Chapman (C & P).	8. 3. 8. 10–11.

Pitymys ibericus pascuus Miller.

1908. *Pitymys ibericus fuscus* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 206, February, 1908. Not *Arvicola agrestis fusca* (= *Pitymys subterraneus*) Fatio, 1900. Type in British Museum.

1911. *Pitymys ibericus pascuus* Miller, Proc. Biol. Soc., Washington, XXIV, p. 39, February 24, 1911 (Substitute for *fuscus*).

Type locality.—Dehesa de Valencia, Province of Valencia, Spain.

Geographical distribution.—Apparently confined to the Dehesa de Valencia.

Diagnosis.—Size as in *Pitymys ibericus centralis*, but colour dark, resembling that of *P. lusitanicus* and *P. pelandonius*.

Colour.—Upper parts a uniform bister, nearly as dark as that of Ridgway, faintly varied by blackish hair tips, and becoming tinged with wood-brown on sides. Underparts dull slaty grey, washed with buffy. Feet whitish in rather marked contrast with body. Tail very obscurely bicolor, whitish except median dorsal region, which is tinged to a varying degree with dark brown.

Skull and teeth.—As in *P. ibericus centralis.*

Measurements.—Type (adult male): head and body, 104; tail, 22; hind foot, 17; ear, 10. Adult male from the type locality: head and body, 107; tail, 27; hind foot, 17. For cranial measurements see Table, p. 789.

Specimens examined.—Two, both from the Dehesa de Valencia.

2 ♂.	Dehesa de Valencia, Spain. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 213-214. (8. 2. 9. 214. *Type* of subspecies.)

Pitymys ibericus regulus Miller.

1908. *Pitymys ibericus regulus* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 206, February, 1908. Type in British Museum.

1909. [*Pitymys*] *i*[*bericus*] *regularis* Lydekker, Zoological Record, XLV (1908), Mamm., p. 75, December, 1909. (Accidental renaming of *regulus.*)

1910. *Pitymys ibericus regulus* Trouessart, Faune Mamm. d'Europe, p. 191.

Type locality.—North slope of the Alhambra hill, Granada, Spain.

Geographical distribution.—Known at present from Granada and Malaga, Spain.

Diagnosis.—General size rather less than in the other forms of *Pitymys ibericus* (hind foot, 15 to 16 mm.); skull with small auditory bullæ; teeth disproportionately reduced (length of tooth-row about 5·4 mm.); colour essentially as in *P. ibericus centralis.*

Measurements.—Type (adult female): head and body, 100; tail, 26; hind foot, 16; ear, 9. Adult female from the type locality: head and body, 97; tail, 21·4; hind foot, 15·4; ear, 8. For cranial measurements see Table, p. 789.

Specimens examined.—Eight, from the following localities in Spain: Granada, 7; Malaga, 1.

2 ♂, 4 ♀.	Granada, Spain.	G. S. Miller (C).	8. 8. 4. 288-293. (8. 8. 4. 290. *Type* of subspecies.)
1 al.	Malaga.	J. G. Haggard (P).	8. 4. 28. 1.

PITYMYS DUODECIMCOSTATUS de Sélys-Longchamps.

1839. *Arvicola duodecimcostatus* de Sélys-Longchamps, Revue Zoologique, p. 8, January, 1839.

1905. *Microtus duodecimcostatus* Major, Ann. and Mag. Nat. Hist., 7th ser., XV, p. 508.

1908. *Pitymys duodecimcostatus* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 204, February, 1908.

1910. *Pitymys duodecimcostatus* Trouessart, Faune Mamm. d'Europe, p. 192.

Type locality.—Geneva, Switzerland? In the original description it is merely stated that the type was received from Professor Pictet de la Rive, of Geneva.* Later de Sélys wrote of the

* "Je dois le squelette que je possède à la générosité de M. le professeur Pictet de la Rive (de Genève)."

animal as occurring at Geneva.* All recent attempts to rediscover the species in Switzerland have, however, led thus far to no result. A specimen in the United States National Museum labeled Geneva, Switzerland, was received in 1857 from the late H. de Saussure.

Geographical distribution.—Mediterranean coast region of France; northward to western Switzerland? Limits of range unknown.

Diagnosis.—Similar to *Pitymys ibericus*, but skull with occiput more obliquely truncate, so that condyles are plainly visible when skull is viewed from above; interparietal narrowly ligulate instead of broadly ligulate or lozenge-shaped.

Colour.—As in *P. ibericus centralis.*

Skull and teeth.—Except for the peculiarities already noted the skull so closely resembles that of *Pitymys ibericus* as to need no detailed description. Teeth as in *P. ibericus.*

Measurements.—Four adults from the vicinity of Marseilles, France (skins): tail, 25, 26, 26 and 27; hind foot, 16·4, 16·6, 16·6 and 16·8. For cranial measurements see Table, p. 790.

1. No locality. Purchased (Parzudaki). 52. 5. 27. 56.

PITYMYS PROVINCIALIS Miller.

1909. *Pitymys provincialis* Miller, Ann. and Mag. Nat. Hist., 8th ser., III, p. 420, May, 1909. Type in British Museum.
1910. *Pitymys provincialis* Trouessart, Faune Mamm. d'Europe, p. 191.

Type locality.—Saint-Gilles, Gard, France.

Geographical distribution.—At present known from a few localities in southern France (departments of Gard and Var).

Diagnosis.—Size small (hind foot about 14·6 mm.; condylobasal length of skull, 22·6 to 23 mm.; upper tooth-row, 5·0 to 5·2 mm.); skull essentially as in *Pitymys duodecimcostatus*, except for its much smaller size; auditory bullæ very small and flat.

Colour.—Upper parts a light wood-brown, becoming paler and more cream-buff on sides; underparts a light grey formed by the blending of slate-grey under colour with creamy white of hair-tips; feet soiled whitish; tail whitish throughout, the upper surface sprinkled with brown hairs. Young ecru-drab faintly tinged with wood-brown, the underparts and feet dull greyish.

Skull and teeth.—The skull of *Pitymys provincialis* is immediately distinguishable from that of *Pitymys duodecimcostatus*, its only near geographical ally, by its exceedingly small size, a character in which it essentially agrees with *P. lusitanicus* and the related small species of the Iberian Peninsula. From these it differs in the conspicuously projecting upper incisors and the very narrow interorbital region. Brain-case unusually deep relatively to length of skull, its outline when viewed from

* Études de Micromammalogie, pp. 110, 111.

above sub-orbicular, the sides strongly rounded off. Occiput not so obliquely truncate as in *P. duodecimcostatus*, and interparietal less narrowly ligulate ; in both characters it more closely resembles *P. ibericus*. Rostrum very slender, though perhaps not disproportionately so. Auditory bullæ smaller and more flattened than in any other member of the group except *P. depressus* of central Spain, their contrast with the large bullæ of *P. duodecimcostatus* particularly noticeable. Upper incisors very strongly projecting, practically the entire front surface of the teeth visible when skull is viewed from above. Molars showing no peculiarities of enamel pattern, but smaller and weaker than in any other member of the group, the small Iberian species not excepted.

Measurements.— External measurements of type (adult female) : head and body, 96 ; tail, 22 ; hind foot, 14·6. For cranial measurements see Table, p. 790.

Specimens examined.—Eleven, from the following localities in France : St. Gilles, Gard, 5 ; Province of Var, 1 ; no exact locality ("Provence"), 4 (B.M. and U.S.N.M.).

2 ♂, 2 ♀.	St. Gilles, Gard, France.	G. S. Miller (c). (8. 8. 4. 265. *Type* of species.)	8. 8. 4. 262–265.
1.	Provence.	Baron E. de Sélys-Longchamps (p).	45. 7. 5. 9.
2.	Var	Purchased (Parzudaki).	52. 5. 27. 51–52.

PITYMYS THOMASI Barrett-Hamilton.

1903. *Microtus* (*Pitymys*) *thomasi* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., xi, p. 306, March, 1903. Type in British Museum.
1905. *Microtus* (*Pitymys*) *thomasi* Major, Ann. and Mag. Nat. Hist., 7th ser., xv, p. 515, May, 1905.
1910. *Pitymys thomasi* Trouessart, Faune Mamm. d'Europe, p. 188.

Type locality.—Vranici, Montenegro.

Geographical distribution.—Known only from Montenegro.

Diagnosis.—Size about the maximum for a European species of *Pitymys* (hind foot about 17·4 mm., condylobasal length of skull about 27 mm.). Cranial and dental characters essentially as in *Pitymys ibericus*. Colour dark, as in *P. lusitanicus*.

Colour.—Upper parts a dark hair-brown, tinged with bister along back and with wood-brown on sides ; underparts slaty grey washed with buffy ; feet dull whitish ; tail obscurely bicolor, the median dorsal area brownish, the rest nearly white.

Skull.—Except in its larger size the skull does not differ very appreciably from that of true *Microtus ibericus*. The dorsal profile is, however, slightly more convex, owing to the greater depth of the anterior portion of brain-case, the general outline of the brain-case tends more to assume a nearly circular form, and the auditory bullæ appear to be relatively larger.

Teeth.—As in *P. ibericus ibericus*.

Measurements.—Type (adult female) : head and body, 118 ; tail, 22 ; hind foot (dry), 17·4 ; ear, 10. Adult male : head

and body, 107; tail, 23; hind foot, 17; ear, 10. For cranial measurements see Table, p. 790.

Specimens examined.—Four, from the following localities in Montenegro: Beri, 1; Daljans, 1; Vranici, 2.

Remarks.—Among the members of the group to which it belongs this species is easily recognizable by its dark colour and large size.

♂. Beri, Montenegro. (*L. Führer.*) O. Thomas (P). 5. 8. 4. 23.
♀. Daljans. (*L. Führer.*) O. Thomas (P). 5. 8. 4. 25.
♂, ♀. Vranici. (*L. Führer.*) O. Thomas (P). 5. 8. 4. 24, 26.
(5. 8. 4. 26. *Type* of species.)

PITYMYS ATTICUS Miller.

1910. *Pitymys atticus* Miller, Ann. and Mag. Nat. Hist., 8th ser., VI, p. 460, November, 1910. Type in British Museum.

Type locality.—Kephissia, near Athens, Greece.

Geographical distribution.—Known only from the type locality.

Diagnosis.—Size much smaller than in the only other known form occurring in the Balkan Peninsula, *P. thomasi*, and about equal to that of *P. duodecimcostatus*. Differs from the latter in less projecting upper incisors and less obliquely truncate occiput.

Colour.—Upper parts buffy wood-brown very inconspicuously lined with black, the sides a little paler and approaching a dull ochraceous-buff behind ear, on flanks and across rump. There is no true line of demarcation along sides, but transition to buffy white of underparts is rather abrupt. Basal portion of fur everywhere slate-colour, this appearing at surface throughout underparts. Feet buffy white in strong contrast with back. Tail obscurely bicolor, pale cream-buff below, buffy wood-brown above. Muzzle tinged with hair-brown.

Skull.—The skull of the type is so injured that its exact form cannot be seen. Apparently it most nearly resembles the skull of *Pitymys duodecimcostatus* in size, but differs in the shorter, broader and deeper rostrum and nasals, relatively wider interorbital region, less strongly projecting incisors and less obliquely truncate occiput. Auditory bullæ flatter and less inflated than in *P. duodecimcostatus*, though of about the same diameter (not reduced as in *P. provincialis*).

Teeth.—The teeth are essentially like those of *Pitymys duodecimcostatus* and *P. thomasi*, but the anterior outer re-entrant angle of m_1 is more pronounced than in any of the skulls of the two related species with which I have compared it.

Measurements.—Type (adult female): head and body, 95; tail, 25; hind foot (dry), 16; ear, 8·2. For cranial measurements see Table, p. 790.

Specimen examined.—The type.

1. Athens, Greece. (*C. Mottaz.*) Hon. N. C. Rothschild (P). 8. 10. 2. 51. (*Type* of species.)

CRANIAL MEASUREMENTS OF *PITYMYS LUSITANICUS*, *P. MARIÆ*, *P. PELANDONIUS*, *P. DEPRESSUS* AND *P. IBERICUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Occipital breadth.	Occipital depth.	Palatal depth.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
P. lusitanicus.														
Portugal: Cintra . . .	98. 2. 2. 40	♂	23·2	13·6	4·0	11·0	6·0	6·8	6·0	7·2	15·2	5·4	5·4	
,, . . .	98. 2. 2. 41	♂	22·8	13·4	4·0	11·0	6·2	6·8	6·0	7 0	14·8	5·6	5·4	
,, . . .	98. 2. 2. 42	♂	22·6	14·0	4·0	11·2	6·0	6·8	6·0	7·0	14·6	5·4	5·4	
,, . . .	98. 2. 2. 50	♂	23·0	13·8	4·0	11·2	6·0	7·2	6·0	7·2	15·0	5·6	5·6	
,, . . .	153029	♀	22·8	13·8	4·0	11·0	6·0	7·0	6·0	7·2	15·2	5·4	5·6	
,, . . .	153437	♀	23·0	14·0	4·0	11·2	6·2	7·2	6·0	7·0	15·0	5·4	5·6	
P. mariæ.														
Spain: Villalba, Lugo . .	94. 1. 1. 16*	♀	22·2	13·0	3·4	9·8	5·0	6·4	6·0	6·6	14·0	5·6	5·4	
P. pelandonius.														
Spain: Silos, Burgos . .	8. 8. 4. 294*	♀	22·0	14·0	3·8	10·6	5·6	6·8	6·0	6·6	14·4	5·4	5·6	
P. depressus.														
Spain: Rascafria, Madrid . .	6. 11. 4. 14	♀	22·0	13·6	4·0	11·0	5·6	6·6	6·0	7·0	14·8	5·6	5·8	
,, ,, . .	6. 11. 4. 15*	♀	22·4	14·0	3·6	11·2	5·4	6·8	6·2	6·4	14·8	5·6	5·6	Old.

P. ibericus ibericus.													
Spain: Elche, Alicante . .	172187	♂	—	—	4·0	—	—	—	7·0	8·8	17·8	6·2	6·2
P. ibericus regulus.													
Spain: Granada . . .	8. 8. 4. 290*	♀	25·0	15·0	4·0	12·0	6·2	8·0	6·4	8·0	16·6	5·4	5·4
,, . . .	8. 8. 4. 293	♀	24·0	14·8	3·8	12·0	6·4	8·0	6·8	7·8	16·2	5·4	5·4
Malaga . . .	8. 4. 28. 1		24·6	15·4	3·8	—	6·4	8·0	6·4	8·0	16·4	5·6	5·4
P. ibericus pascuus.													
Spain: Dehesa de Valencia .	8. 2. 9. 214*	♂	24·2	14·8	4·2	12·0	6·6	8·0	6·6	8·0	15·8	6·0	6·0
P. ibericus centralis.													
Spain: Silos, Burgos . .	8. 8. 4. 278*	♂	25·0	15±	4·2	12·0	7·0	8·0	7·0	8·4	17·2	6·0	6·2
,, ,, . .	8. 8. 4. 283	♂	25·0	14·8	4·2	11·8	6·4	7·4	6·4	8·4	17·0	6·0	6·2
,, ,, . .	8. 8. 4. 284	♂	24·8	15·0	4·0	11·8	6·8	7·8	6·8	8·0	16·8	6·0	6·0
,, ,, . .	172182	♀	24·4	15·0	4·0	11·8	6·6	7·6	7·2	8·4	16·6	6·0	6·0
,, ,, . .	172183	♀	24·6	14·8	4·0	11·8	6·2	7·2	7·0	8·2	16·0	5·8	6·0
Seville	95. 3. 3. 29	♂	24·0	14·4	4·0	11·6	6·0	7·2	—	8·0	16·0	6·0	6·0
,, ...	105744	♂	25·2	16·2	4·0	12·0	6·8	7·8	7·0	8·0	17·0	6·0	6·2
,, ...	153466		25·2	15·4	3·8	11·8	6·2	7·6	6·4	8·0	16·6	6·0	6·2
,, ...	105742	♀	24·8	15·0	3·6	11·4	6·4	7·6	6·2	8·0	16·4	6·0	6·2

* Type.

CRANIAL MEASUREMENTS OF *PITYMYS DUODECIMCOSTATUS*, *P. PROVINCIALIS*, *P. THOMASI* AND *P. ATTICUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Occipital breadth.	Occipital depth.	Palatal depth.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
P. duodecimcostatus.														
France: near Marseilles . .	2193 Lataste	♀	25·2	15·8	4·0	12·8	7·2	8·0	6·6	8·4	17·0	5·8	6·0	
,, . .	2197 ,,		24·0	16·4	4·0	11·8	6·6	8·0	6·4	8·0	16·0	5·8	5·8	
,, . .	2199 ,,		24·8	15·2	4·0	12·2	6·8	8·0	6·8	8·2	16·8	5·8	6·2	
,, . .	2201 ,,		25·2	16·0	3·6	12·8	6·8	8·0	6·8	8·4	16·8	5·6	6·0	Old.
P. provincialis.														
France: Department of Var .	883 Lataste		22·8	13·6	4·0	10±	6·0	7·4	6·0	7·6	15·4	5·2	5·2	
,, .	52. 5. 27. 5		—	14±	3·8	—	—	7·4	6·2	8·0	15·8	5·2	5·4	
,, .	45. 7. 5. 9		22·8	14·2	4·0	—	6·6	7·0	6·0	7·8	15·0	5·0	5·2	
no exact locality .	52. 5. 27. 52		22·6	—	3·6	—	—	7·0	6·2	7·6	15·4	5·2	5·4	
St. Gilles, Gard .	8. 8. 4. 265*	♀	22·4	14·4	4·0	11·6	6·8	7·6	5·8	7·8	15·3	5·3	5·2	
P. thomasi.														
Montenegro	5. 8. 4. 23	♂	27·0	17±	3·8	12·4	7·4	8·4	8·0	9·0	18·0	6·4	6·6	
,, ...	5. 8. 4. 26*	♀	26·6	—	3·8	13·0	7·2	8·4	7·6	8·8	18·0	6·4	6·4	
P. atticus.														
Greece: Kephissia, near Athens	8. 10. 2. 51*	♀	—	14·6	4·0	—	—	7·8	6·2	7·2	16·2	6·0	6·2	

* Type.

Sub-Family **MURINÆ.**

1857. *Murinæ* Baird, Mamm. N. Amer., p. 434 (part).

Geographical distribution.—Originally confined to the Old World south of or barely entering the Arctic region, but members of two genera now everywhere artificially distributed.

Characters.—Molars tuberculate, brachyodont, rooted, the tubercles of the maxillary teeth arranged in three primary longitudinal rows; external form with no special modifications.

Remarks.—The sub-family *Murinæ* contains about fifty described genera, five of which occur in Europe.

KEY TO THE EUROPEAN GENERA OF *MURINÆ.*

Mesopterygoid fossa reduced to a triangular space scarcely extending in front of hamulars; coronoid process of mandible obsolete; back densely and conspicuously spinous (Crete)..... *Acomys*, p. 883.

Mesopterygoid fossa normal, extending decidedly in front of hamulars, its sides usually parallel or nearly so; fur not spinous, though back sometimes with inconspicuous flattened bristles (Distribution general).

First and second upper molars with two tubercles on inner side.

Upper incisor with outer side of cutting edge entire; first upper molar 5-rooted, its crown not so long as that of m^2 and m^3 combined; size large (House-rats)..... *Epimys*, p. 848.

Upper incisor with outer side of cutting edge broken by conspicuous notch and projection; first upper molar 3-rooted, its crown longer than that of m^2 and m^3 combined; size small (House-mice) *Mus*, p. 863.

First and second upper molars with three tubercles on inner side when unworn.

Tail not prehensile, completely haired at tip; ear without lobe closing meatus; rostral portion of skull normally developed, the length of diastema notiœably greater than depth at front of m^1 (Field-mice)..... *Apodemus*, p. 791.

Tail prehensile, naked at tip above; ear with conspicuous lobe closing meatus; rostral portion of skull so shortened that length of diastema is less than depth at front of m^1 (Harvest-mice)... *Micromys*, p. 840.

Genus **APODEMUS** Kaup.

1829. *Apodemus* Kaup, Entw.-Gesch. u. Natürl. Syst. Europ. Thierwelt., I, p. 150 (*agrarius*).

1857. *Mus* Blasius, Säugethiere Deutschlands, p. 309 (part).

1905. *Micromys* Thomas, Ann. and Mag. Nat. Hist., 7th ser., XV, p. 492, May, 1905 (part).

1908. *Apodemus* Thomas, Ann. and Mag. Nat. Hist., 8th ser., I, p. 447, May, 1908 (part).

Type species.—*Mus agrarius* Pallas.

Geographical distribution.—Northern temperate portion of

Old World from Ireland to Japan, south to northern India and the Mediterranean region of Africa.

Characters. Skull without special modifications of form, the rostral portion well developed (diastema noticeably exceeding depth of skull at anterior root of m^1), the mesopterygoid fossa squarish or broadly double- or single-rounded anteriorly; first and second upper molars with three cusps on inner side; ear without valve for closing meatus; tail not prehensile; fur without spines.

Remarks.—Among Palæarctic *Muridæ* the genus *Apodemus* is well characterized by the complicated pattern of enamel folding, the non-prehensile tail, and the normal skull. A similar combination of peculiarities occurs, however, in the African *Thamnomys*. About a dozen species are known, seven of which occur in Europe.

KEY TO THE EUROPEAN FORMS OF *APODEMUS*.

First lamina of m^1 with crescentic form much distorted; m^2 with no antero-external tubercle; interorbital region with conspicuously beaded edges; back with black median line (Eastern Europe, west to Denmark)..... *A. agrarius*, p. 834.

First lamina of m^1 with crescentic form not distorted; m^2 with small but distinct antero-external tubercle; interorbital region with edges not beaded; back with no black median line.

First upper molar with four tubercles on outer margin of crown; alveolar width of m^1 equal to about half greatest width of palate between tooth-rows; size maximum for the European members of the genus, the condylobasal length of skull not infrequently more than 30 mm.; colour above buffy grey (Balkan Peninsula)... *A. epimelas*, p. 794.

First upper molar with three tubercles on outer margin of crown; alveolar width of m^1 less than half greatest width of palate between tooth-rows; size never attaining maximum for European members of the genus, the condylobasal length of skull seldom attaining 28 mm.

Skull becoming massive and relatively angular in old age, the brain-case eventually with low but evident lateral ridges; size large, the hind foot most frequently 25 mm. in length (23–27 mm.); condylobasal length of skull in individuals with noticeably worn teeth most frequently 26 mm. (25–29 mm.) *A. flavicollis*, p. 828.

Underparts usually creamy white, the pectoral spot usually not forming complete collar and not spreading backward over chest (Continental Europe north of Mediterranean region)..... *A. f. flavicollis*, p. 829.

Underparts usually greyish white, the pectoral spot usually forming complete collar and spreading backward over chest (England) *A. f. wintoni*, p. 831.

Skull remaining light and smooth, even in extreme old age, the brain-case never developing evident lateral ridges; size medium or small, the hind foot most frequently 22–23 mm. (20–25 mm.);* condylobasal length of skull in individuals with noticeably worn teeth most frequently 23–24 mm. (21–26 mm.).*

General form of skull slender, especially in rostral portion; mandible with coronoid process reduced; colour dusky above, dull white below, the pectoral spot obsolete; size maximum for this section, the hind foot and condylobasal length of skull sometimes exceeding 26 mm. (Fair Isle, Scotland)..... *A. fridariensis*, p. 825.

General form of skull normal, the coronoid process of mandible well developed; colour reddish, yellowish or pallid above, underparts whitish or washed with brown, the pectoral spot usually well developed; size moderate or small.

Underparts always heavily washed with yellowish brown; ear shortened and narrowed.

Condylobasal length of skull 24 to 25 mm. (Hebrides, Scotland)..... *A. hebridensis*, p. 824.

Condylobasal length of skull 25·6 to 27 mm. (St. Kilda Island, Scotland) *A. hirtensis*, p. 825.

Underparts usually whitish, occasionally washed with yellowish brown; ear normal..... *A. sylvaticus*, p. 797.

Size small, hind foot most frequently 22 mm., condylobasal length of skull most frequently 23 mm.

General colour above rich yellowish brown usually with a decided russet tinge (Europe north of Mediterranean region)..... *A. s. sylvaticus*, p. 803.

General colour above light yellowish brown without russet (Crete)..... *A. s. creticus*, p. 813.

Size medium, hind foot most frequently 23 mm., condylobasal length of skull most frequently 25 mm.

General colour above rich yellowish brown usually with a decided russet tinge (Pyrenees, Asturias and Portugal)..... *A. s. callipides*, p. 809.

General colour above pale yellowish or greyish brown without russet (Mediterranean region in general) *A. s. dichrurus*, p. 810.

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* These dimensions exceeded in the local form inhabiting Fair Isle, Scotland.

APODEMUS EPIMELAS Nehring.

1882. *Mus mystacinus* Winge, Vidensk. Meddel. fra den naturh. Foren. i Kjøbenhavn, 4th ser., III (1881), p. 21 (Dekelia, near Athens, Greece). Not *Mus mystacinus* Danford and Alston.

1902. *Mus epimelas* Nehring, Sitz.-Ber. Gesellsch. Naturforsch. Freunde, Berlin, p. 95, February, 1902.

1910. *Mus* (*Epimys*) *epimelas* Trouessart, Faune Mamm. d'Europe, p. 144.

Type locality.—Agoriani, Parnassus, Greece.

Geographical distribution.—Balkan Peninsula, west to Cephalonia, Corfu and Montenegro.

Diagnosis.—Largest European member of the genus; adults with hind foot, 26 to 29 mm., condylobasal length of skull, 28 to 31 mm.; colour light greyish buff with no decided yellowish or russet tinge, the back noticeably clouded with black: skull and teeth essentially as in *Apodemus sylvaticus* except for their greater size, but molars relatively larger, the alveolar width of m^1 equal to about one-half width of palate, m^1 and m^2 with minute though evident fourth tubercle at postero-external margin of crown, and outer ledge of m_1 and m_2 somewhat better developed.

External characters.—As in *Apodemus sylvaticus* except for such differences as are correlated with larger size. Ear large, completely covering eye when laid forward, its form not peculiar. Palmar and plantar tubercles apparently larger than in *A. sylvaticus* (only dry specimens examined); sole completely bare to heel. Tail about as long as head and body, the annulations plainly visible, fourteen to the centimeter at middle, the hairs rather sparse, their length equal to width of about three rings; pencil scarcely indicated.

Colour.—Entire upper parts cream-buff with a faint greyish tinge, everywhere darkened by an admixture of blackish hair-tips, these inconspicuous on sides of body but numerous enough over middle of back to produce a noticeable dark clouding; cheeks, sides of neck, outer surface of front legs, and region behind ears nearly clear cream-buff; underparts and inner surface of legs buffy white, the line of demarcation along sides sharply defined; feet white; ear an indefinite dark brown; tail sharply bicolor, the hairs on upper surface blackish, those on lower surface white. In immature individuals the cream-buff is replaced by smoke-grey, the black remaining essentially as in the adults.

Skull.—In all essential respects, apart from its conspicuously greater size, the skull agrees with that of *Apodemus sylvaticus*. As in the smaller animal the brain-case remains smooth above, even in extreme old age, never developing the lateral ridges found in old individuals of *A. flavicollis*. Anterior border of incisive foramina extending relatively further for-

ward than in *A. sylvaticus*, the distance from foramen to alveolus of incisor barely more than half combined width of the two foramina instead of nearly equal to it.

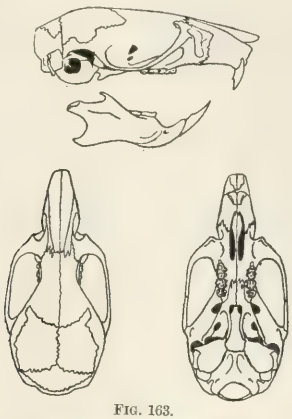


FIG. 163.
Apodemus epimelas. Nat. size.

Teeth.—Though in general resembling those of *Apodemus sylvaticus*, the teeth of *A. epimelas* differ in several important details. The crowns of all the cheek-teeth are perceptibly

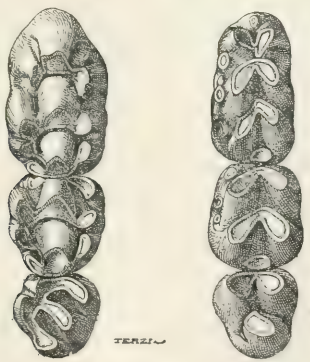


FIG. 164.
Apodemus epimelas. Cheek-teeth. × 10.

longer proportionately to their breadth than in the smaller animal, but at the same time the distance between the upper tooth-rows is so reduced that the alveolar breadth of m^1 is fully

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Breadth of brain-case.	Depth of brain-case at middle.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
A. epimelas.													
Montenegro	5. 8. 4. 10	♂	28·0	14·8	4·8	14·0	9·0	11·6	8·2	16·8	4·8	4·8	Teeth moderately worn.
,,	5. 8. 4. 11	♂	30·0	15·4	5·0	14·0	9·2	12·8	8·4	18·2	5·2	5·0	,, much worn.
,,	5. 8. 4. 12	♂	30·0	15·2	4·8	13·8	8·8	12·6	8·4	18·4	5·0	5·0	,, ,,
,,	5. 8. 4. 13	♀	28·4	15·0	5·0	14·2	9·4	11·8	8·2	17·2	5·0	5·0	,, moderately worn.
,,	5. 8. 4. 14	♀	28·4	15·4	5·0	13·8	9·0	11·6	8·2	17·2	5·0	5·0	,, ,,
Northern Albania	5. 8. 4. 27	♂	28·2	15·2	4·8	14·0	9·0	11·8	8·0	17·0	5·0	4·8	,, slightly worn.
,,	5. 8. 4. 28	♂	28±	15·0	5·0	13·6	—	12·0	8·0	17·2	5·0	4·8	,, moderately worn.
,,	5. 8. 4. 29	♂	27·0	15·0	4·8	14·0	8·8	11·0	8·0	16·6	5·0	5·0	,, slightly worn.
,,	5. 8. 4. 30	♂	28·0	15·2	5·0	14·0	9·2	11·6	8·0	17·0	5·2	5·0	,, moderately worn.
,,	5. 8. 4. 32	♀	30·0	15·6	5·0	14·0	9·6	12·8	8·6	18·6	5·2	5·0	,, much worn.
,,	5. 8. 4. 33	♀	29±	15·4	4·8	14·2	9±	12·0	8·4	18·2	5·0	4·8	,, ,,
Greece: Cephalonia	153367	♂	—	—	5·0	—	—	12·8	8·8	18·6	5·4	5·2	,, ,,
,,	8. 10. 1. 27	♀	30·0	16·6	4·6	14·4	9·2	12·8	8·6	18·0	5·2	5·0	,, slightly worn.
,,	153366	♀	29·0	16·4	4·8	14·4	9·4	12·6	8·2	18·2	5·6	5·4	,, ,,
Tatoi, near Athens	153368	♂	31·0	16·0	5·0	14·8	10·0	13·0	8·8	18·8	5·2	5·2	,, much worn.
,, ,,	153371	♂	30·0	15·6	5·0	14·2	9·0	12·8	8·8	18·4	5·6	5·2	,, ,,
,, ,,	153374	♀	—	—	4·8	14·2	9·6	12·6	8·4	17·8	5·2	5·2	,, ,,
A. mystacinus.													
Asia Minor: Zebil, Taurus	77. 8. 13. 6*	♂	28·6	15·6±	4·8	14·2	8·8	11·8	8·2	17·2	4·6	4·8	,, moderately worn.
Kara Dagh	8. 7. 1. 22	♀	28·2	15·2	4·6	13·6	9·0	11·8	8·2	17·2	4·8	4·8	,, ,,
,,	8. 7. 1. 23	♀	28·4	15·6	4·8	14·0	9·2	11·6	8·2	17·8	4·8	4·8	,, much worn.
Scalita	6. 3. 6. 90	♂	27·6	15·4	4·8	13·6	8·8	—	8·0	17·0	4·8	4·6	,, ,,
,,	6. 3. 6. 91	♂	27·2	14·6	4·6	13·4	8·8	11·4	8·0	16·2	4·8	4·4	,, moderately worn.
,,	6. 3. 6. 93	♂	28·0	15·2	4·6	14·0	9·0	11·8	8·0	17·0	4·6	4·4	,, much worn.
,,	6. 3. 6. 100	♀	27·6	15·0	4·6	13·8	9·0	11·2	8·0	16·8	4·8	4·8	,, ,,
,,	6. 3. 6. 103	♀	27·4	15·2	4·8	13·4	9·0	11·8	8·0	17·2	4·8	4·6	,, moderately worn.
,,	6. 3. 6. 106	♀	27·0	—	4·4	13·4	8·8	11·8	7·8	16·8	4·4	4·2	,, much worn.

* Type.

equal to one-half width of palate in same region. Pattern of enamel folding essentially as in *Apodemus sylvaticus*, but re-entrant angles of first lamina of m^1 without rudimentary supplemental loops; postero-external border of crown of m^1 and m^2 with small though evident supplemental tubercle appearing in worn teeth as a narrow outward-projecting loop; outer ledge and rudimentary tubercles of m_1 and m_2 better developed than in *A. sylvaticus*, those of the second tooth nearly as large as those of first, a condition rarely if ever occurring in the smaller animal.

Measurements.—Adult male from Montenegro: head and body, 150; tail, 146; hind foot, 26; ear from meatus, 20. Adult male from northern Albania: head and body, 135; tail, 115; hind foot, 27; ear from meatus, 19. Adult male from Corfu, Greece: head and body, 128; tail, 134; hind foot, 27·5; ear from meatus, 21·7. Adult female from Cephalonia, Greece: head and body, 131; tail, 129; hind foot, 27·4; ear from meatus, 20·8. Adult male from the same locality: tail, 120; hind foot, 29; ear from meatus, 20·8. For cranial measurements see Table opposite.

Specimens examined.—Thirty-five, from the following localities:—
Montenegro: No exact locality, 6.
Albania: Northern Albania, 8.
Greece: Corfu, 3; Cephalonia, 6; near Athens, 12.

Remarks.—While *Apodemus epimelas* is very unlike the other European members of the genus it closely resembles *A. mystacinus* Danford and Alston from Asia Minor, differing chiefly in its somewhat larger skull and heavier teeth (see measurements in Table opposite), and also in the slightly duller, less buffy ground colour of upper parts.

3 ♂, 3 ♀.	Montenegro. (*L. Führer.*)	O. Thomas (P).	5. 8. 4. 10–15.
4 ♂, 4 ♀.	North Albania. (*L. Führer.*)	O. Thomas (P).	5. 8. 4. 27–34.
2 ♂.	Corfu, Greece. (*C. Mottaz.*)	J. I. S. Whitaker (P).	8. 10. 1. 28–29.
♂, ♀.	Argostoli, Cephalonia. (*C. Mottaz.*)	J. I. S. Whitaker (P).	8. 10. 1. 26–27.
♂, ♀.	Tatoi, Athens. (*C. Mottaz.*)	Hon. N. C. Rothschild (P).	8. 10. 2. 38–39.

APODEMUS SYLVATICUS Linnæus.

(Synonymy under subspecies.)

Geographical distribution.—Central and southern Europe from Ireland eastward and from the Mediterranean coast north at least to central Scandinavia; northern limits of range not known.

Diagnosis.—Size small or medium; head and body, about 95 to 105; tail vertebræ, about 80 to 110; hind foot, 20 to 25, most frequently 22 or 23; condylobasal length of skull, 22 to 26 mm.; ear large, its height from meatus about 16 to 18 mm.; general colour of upper parts ranging in different local forms

from a bright russety wood-brown nearly to buff and greyish drab; underparts whitish, sometimes a nearly pure bluish or creamy white, more often tinged with slaty or washed with yellowish brown, the line of demarcation along sides always sharply defined in adults; a yellowish brown spot or longitudinal streak usually present on middle of chest between fore legs, this spot rarely spreading to form a complete collar; teeth rather weak, the alveolar width of m^1 less than half width of palate between tooth-rows; m^2 with three distinct tubercles on outer side, but neither this tooth nor m^1 with well-developed supplemental loop behind third outer tubercle (sometimes a slight trace of this loop in m^1); outer side of m_1 and m_2 with noticeable cingulum-like ledge extending nearly entire length of crown and bearing distinct though minute cusps; skull remaining light and smooth even in extreme old age, the interorbital margins not beaded, the brain-case never developing evident lateral ridges; rostrum not specially elongated; mandible with well developed coronoid process.

External characters.—External form slender, much as in the house mouse, but feet, eyes and ears relatively larger. Ear extending slightly but evidently beyond eye when laid forward, its general outline broadly ovate, sometimes a little flattened above and on posterior border; antitragus reduced to a low inconspicuous ridge not capable of closing meatus; surface of ear finely pubescent. Muzzle with ill-defined naked area surrounding nostrils; nostril opening obliquely forward and outward, wider anteriorly than posteriorly, its inner and lower margin thickened and irregularly wrinkled; a deep furrow under lower border and another dividing nostrils in median line and continuous below with cleft in upper lip. Feet slender, without special modifications. Thumb reduced to a mere tubercle, the upper surface of which is covered by the rudimentary nail; palm naked, 5-tuberculate, the tubercles well developed, distinct, the two hindermost slightly larger than the others, but showing no tendency to unite along median line, the surface of the palm between the tubercles irregularly wrinkled; under surface of digits with five or six deep transverse furrows. Hind foot relatively longer and more slender than in the house mouse, the three median toes sub-equal, the outer extending almost to end of first phalanx of fourth, the inner scarcely to base of first phalanx of second, the under surface marked off by conspicuous cross furrows into well defined, entire, scales or plates, of which there are seven or eight on the longer toes. Sole naked except at sides of heel (this hairy area sometimes extending completely across), its surface papillose in region among tubercles, rugose at heel, smooth between last tubercle and wrinkled posterior portion; tubercles six, well developed and distinct, ovate in outline, the four anterior largest and sub-equal, the postero-external smallest. Tail about as long as head and body,

somewhat quadrate in section, the annulations distinct, about eighteen to the centimeter at middle; hairs rather sparse, not concealing the annulations at middle but forming a small though evident pencil at tip, their length equal to width of $2\frac{1}{2}$ rings. Mammæ: p 1—1, i 2—2=6.

Colour.—For detailed description of colour see accounts of subspecies.

Skull.—The skull is moderately large, smoothly rounded, and without any striking characteristics. Dorsal surface straight and gradually rising from tip of nasals to middle of frontals, then moderately convex to back of interparietal, the convexity most strongly marked over middle of parietals; ventral profile horizontal to back of molars, then bent rather abruptly downward to lowest portion of bulla. Brain-case ranging from broadly ovate to sub-circular in outline when viewed from above, its surface everywhere smoothly rounded except for the faintly angular posterior border to orbits, a slight perpendicular ridge in mastoid region, and in very old individuals a barely indicated lambdoid angularity. Interparietal rather large but narrow, its extremities gradually tapering and usually rather sharp-pointed. Posterior aspect of occiput low and narrow, much exceeded in height by the median region of brain-case; paroccipital processes small and inconspicuous, close to outer surface of condyle. Floor of brain-case with no conspicuous features, the basioccipital with low median ridge and shallow lateral excavations; bulla moderate, smoothly rounded, the large meatus with faintly indicated tubular rim. Interorbital region somewhat abruptly though not very narrowly constricted, flat above, the margins rounded anteriorly, squarely angled posteriorly but never raised, and bead-like. Zygoma slender, rather abruptly but not widely spreading anteriorly, the median portion of the two arches essentially parallel when viewed from above. Plate forming outer border of infraorbital canal well developed, its anterior border perpendicular. Rostrum slender, not elongated, the nasals simple, narrowing gradually backward, their posterior termination squarely truncate or bluntly pointed, usually a little in front of posterior extremity of nasal branches of premaxillaries and of level of front of lachrymal. Incisive foramina rather long, parallel-sided, extending from about 1–1·5 mm. behind incisors to level of anterior root of m^1; palate nearly flat, without special features, the portion formed by palatine bones extending forward to middle of m^1; mesopterygoid space narrow anteriorly,

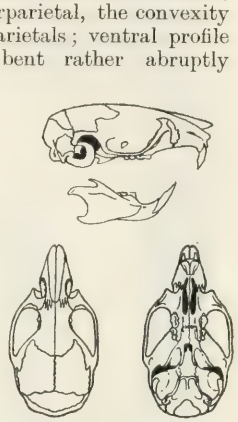


Fig. 165.

Apodemus sylvaticus. Nat. size.

wider posteriorly, its anterior border straight or faintly curved, usually not extending forward quite to level of last molar; hamulars slightly thickened at tip, curved a little outward, barely or not in contact with bullæ; ectopterygoid well developed, nearly horizontal, its posterior portion spreading considerably beyond outer alveolar line. Mandible slender, with no special peculiarities of form; coronoid process small but well developed, directed noticeably backward, its extremity about on level with condyle; angular process long and rather slender, its inner surface with noticeable longitudinal concavity; dental foramen at level of alveoli; projection marking root of incisor slight but evident, directly under base of coronoid process.

Teeth.—Relatively to size of skull the teeth are rather small: alveolar breadth of m^1 distinctly less than half greatest width of palate between tooth-rows; alveolar length of upper tooth-row a little less than half diastema. Upper incisor strongly curved,

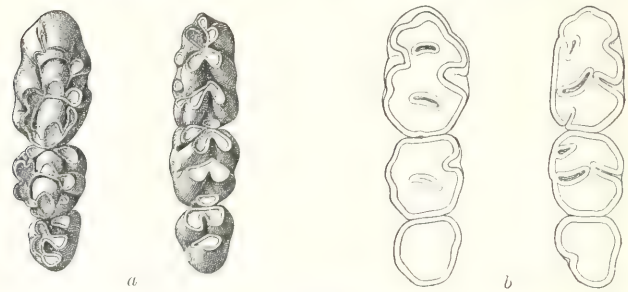


FIG. 166.

Apodemus sylvaticus. Cheek-teeth, (*a*) slightly worn; (*b*) much worn. × 10.

forming nearly half of a circle, its root appearing as an evident protuberance on side of rostrum slightly in front of lower portion of infraorbital foramen; shaft compressed, nearly triangular in section, its antero-posterior diameter about double its greatest width, the anterior and inner faces flat, joining each other at a well marked nearly right angle, the outer edge of anterior face curving rather broadly into outer face, the curved portion giving this part of the section a somewhat oblique appearance; posterior face narrow, abruptly rounded, not sharply differentiated from outer and inner faces. Lower incisor slightly longer and much less curved than upper incisor, its root forming a protuberance on outer surface of mandible under base of coronoid process and slightly above alveolar level; cross-section of shaft essentially as in upper incisor, but anterior surface relatively narrower. Upper molars with tubercles arranged according to a ground-plan of three longitudinal rows of tubercles, those of the median

row much larger than those of the inner and outer rows, the tubercles of the different rows partly joined by cross-ridges, and so disposed as to form three transverse laminæ having somewhat the form of forwardly-bowed crescents. In each tooth this complete pattern is only approximated; in m^1 it is imperfect posteriorly, in m^2 both anteriorly and posteriorly, while in m^3 it is scarcely more than recognizable. For convenience of description the tubercles representing the complete pattern may be numbered transversely 1 to 9, beginning with the first on inner side and ending with the third on outer side; those of the inner row will therefore be 1, 4 and 7, those of the middle row 2, 5 and 8, those of the outer row 3, 6 and 9. Crown of m^1 more than one and a half times as long as broad, its length nearly and area fully equal to that of two succeeding teeth combined; tubercles of outer row slightly larger than those of inner; anterior crescent slightly distorted by the small size of $t1$ and the very broad, shallow angle between its inner border and the outer border of $t2$; a small but evident projecting supplemental loop usually present in angle between $t3$ and $t2$, a similar but less developed loop occasionally present in that between $t2$ and $t1$; second crescent essentially similar to first, and partly or completely joined to it by a narrow ridge extending between $t3$ and the outer base of $t5$ and occasionally a similar ridge between $t1$ and the outer base of $t5$, the ridges variable in development though rather constant in position; third crescent much distorted by the pushing forward of $t9$ and $t7$ so that the three cusps of this lamina lie in the same transverse line, and the re-entrant angles separating them from $t6$ and $t4$ respectively are much narrower than those behind first lamina; $t9$ is broadly connected with $t6$ anteriorly, so that the two might almost be interpreted as parts of a deeply divided $t6$; $t7$ is similarly connected with $t4$, and, though well developed, is the most reduced cusp in the tooth; postero-external border of crown usually with a faintly indicated supplemental loop, this never so well developed as in *Apodemus epimelas*. Second upper molar sub-circular in outline, its first lamina incomplete by the absence of $t2$; $t3$ very small, terete; second and third laminæ essentially as in m^1; postero-external loop excessively minute, though usually present in unworn teeth. Third upper molar similar to m^2 in form but scarcely half as large. In moderately worn condition it usually has the appearance of a sub-circular tooth with two re-entrant angles on inner side extending about half way across crown and occasionally a slight notch on outer side near middle; when unworn it is possible to identify tubercles 1, 4, 5 and 8, the inner re-entrant angles corresponding to the spaces between first and second and second and third laminæ, the notch on outer surface to the re-entrant angle at front of $t5$. Lower molars consisting of a series of paired, equal, nearly distinct tubercles, each tooth terminating posteriorly in a single median tubercle usually much

smaller than the others. First lower molar with six paired tubercles and a median anterior loop nearly as large as median posterior tubercle. Second lower molar with four paired tubercles and a small median posterior tubercle. Third molar with two paired tubercles essentially like those of the other teeth, but with posterior median tubercle slightly larger than either of the paired tubercles. The relative size of the three teeth is indicated by the number of pairs of tubercles. Outer margin of m_1 and m_2 with a narrow ledge bearing two or three minute terete cusps. The ledges and cusps are variable in their degree of development; usually they are more evident in m_1 than in m_2; in m_1 there are usually two at outer margin of second outer main tubercle, and a third somewhat better developed at margin of postero-external main tubercle; in m_2 the most constant supplemental cusp is that which lies at outer base of antero-external main tubercle; behind this there are usually no distinct supplemental cusps, though one or two are occasionally present.

Remarks.—This is the most abundant and most universally distributed of European mammals. Except in cities, at the extreme north, on the highest mountains, and perhaps in some parts of the Mediterranean region,* it is probably everywhere more numerously represented in individuals than any other species. Adults are readily distinguishable from the house mouse by their brighter colour, larger ear and longer hind foot; but at all ages and in all conditions of pelage the structure of the teeth and the absence of supplemental tubercles to all of the pads on palm and sole differentiate it from all members of the genus *Mus*. The only European mammal with which *Apodemus sylvaticus* is likely to be confused is *A. flavicollis*. Detailed comparisons of the two animals will be found under the latter species.

Throughout the greater part of its range, from Ireland to Roumania, and from northern Scotland and central Scandinavia to Switzerland and the plains of south-western France, *Apodemus sylvaticus* is represented by its typical form, small sized and rich in colour, the back in adults in fresh pelage usually with at least a trace of russet. In the Pyrenees, Asturias and Portugal occurs a larger race, which, however, retains the bright colour of true *sylvaticus*. This tendency toward larger size is shown throughout the Mediterranean region, though a small race occurs on the island of Crete. Unlike the Pyrenean-Asturian form the true Mediterranean races are all pale, with yellowish or greyish tints predominating to the exclusion of russet. Along the Mediterranean coast of France, and in northern Italy lies

* In the vicinity of Elche, Alicante, Spain, I found *Apodemus sylvaticus* much less numerous than *Mus spicilegus*, and practically confined to ravines and river banks, while the smaller animal was abundant everywhere.

an area of intergradation between true *sylvaticus* and the larger Mediterranean form. Specimens from this region are indeterminate in characters, though for the most part apparently nearest to the southern race. In addition to the race already alluded to as inhabiting Crete several other insular forms have become to a greater or less degree differentiated. That from the island of Corfu appears to be slightly more grey than that occurring on the mainland of Greece. Specimens from the Channel Islands and Scilly Islands show a tendency to be larger than on the neighbouring mainland. But none of these local races is sufficiently distinct to admit of characterization. On the other hand, the Hebrides, St. Kilda, and Fair Isle, off the coast of Scotland, are each inhabited by a peculiar, well-differentiated form, sufficiently distinct to take rank as a species. The few specimens that I have seen from the Shetland and Orkney Islands appear to be indistinguishable from true *sylvaticus*. It seems probable, therefore, that they have been recently introduced.

Apodemus sylvaticus sylvaticus Linnæus.

1758. [*Mus*] *sylvaticus* Linnæus, Syst. Nat., I, 10th ed., p. 62 (Upsala, Sweden).

1796. *Mus sylvaticus parvus* Bechstein, Getreue Abbild. Naturhist. Gegenstände, I, p. 100 (Thüringen, Germany).

1796. *Mus sylvaticus candidus* Bechstein, Getreue Abbild. Naturhist. Gegenstände, I, p. 100 (Thüringen, Germany).

1796. *Mus sylvaticus varius* Bechstein, Getreue Abbild. Naturhist. Gegenstände, I, p. 100 (Thüringen, Germany).

1796. *Mus sylvaticus niger* Bechstein, Getreue Abbild. Naturhist. Gegenstände, I, p. 100 (Thüringen, Germany).

1801. *Mus syl[vaticus] albus* Bechstein, Gemeinn. Naturgesch. Deutschlands, I, 2d ed., p. 965 (Thüringen, Germany).

1801. *Mus syl[vaticus] leucocephalus* Bechstein, Gemeinn. Naturgesch. Deutschlands, I, 2d ed., p. 966 (Thüringen, Germany).

1827. *Mus islandicus* Thienemann, Reise im Norden Europas, II, p. 153 (Iceland).

1834. *Mus sylvaticus* Melchior, Den Danske Stats og Norges Pattedyr, p. 102.

1839. *Mus intermedius* Bellamy, Nat. Hist. of South Devon, p. 330 (Devonport, Devonshire, England).

1857. *Mus sylvaticus* Blasius, Säugethiere Deutschlands, p. 322 (part).

1900. *Mus sylvaticus intermedius* Barrett-Hamilton, Proc. Zool. Soc., London, p. 398.

1900. *Mus sylvaticus celticus* Barrett-Hamilton, Proc. Zool. Soc., London, p. 401 (Caragh Lake, Co. Kerry, Ireland).

1910. *Mus sylvaticus intermedius* and *M. sylvaticus celticus* Trouessart, Faune Mamm. d'Europe, pp. 149, 150, 151.

1910. [*Apodemus*] *sylvaticus* Miller, Ann. and Mag. Nat. Hist., 8th ser., VI, p. 460, November, 1910.

Type locality.—Upsala, Sweden.

Geographical distribution.—Central Europe from Ireland

eastward, and from central Sweden and Norway south to northern Italy and the southern France; Iceland (probably introduced).

Diagnosis.—Size small; head and body, about 95; tail vertebræ, about 90; hind foot, about 22; condylobasal length of skull, 22 to 24·6 mm.; general colour of upper parts relatively dark and rich, the sides and flanks a russety, yellowish, wood-brown.

Colour. Ordinary adult specimens in fresh pelage are wood-brown above, distinctly tinged with russet on posterior half of back, and becoming paler and more buffy on head, neck, shoulders and sides; everywhere there is a noticeable sprinkling of blackish hairs, these usually producing a decided effect of "lining," and over middle of posterior half of back a slight though evident dark clouding; cheeks, sides of neck, outer surface of fore legs and a narrow, ill-defined region along line of demarcation, dull light buff; underparts and dorsal surface of feet dull white, the throat and belly always clouded by the slate-grey undercolour, and not infrequently with a slight or decided buffy wash; chest usually with a buff median area between fore legs, this occasionally forming a complete collar or spreading backward along median line; ear dull brownish with no decided markings, the edges usually lighter and often faintly silvery; tail bicolor, though in most specimens not conspicuously so, the upper surface dark brown, the under surface whitish. Immature individuals are duller than the adults, the upper parts usually with a plumbeous tinge, the underparts more slaty, so that there is occasionally no well marked line of demarcation along sides. Specimens in this pelage often resemble some of the bicolored forms of the *Mus musculus* group, though they may always be distinguished by their relatively larger eyes and ears, relatively longer hind foot, and by the absence of supplementary tubercles to all of the pads on sole.

Measurements.—Two adult males from Iceland: head and body, 90 and 95; tail, 87 and 92; hind foot, 22·6 and 23·2; ear, 18 and 17·6. Average and extremes of five adults from Ireland: head and body, 97 (90–103); tail, 83·7 (71–97); hind foot, 22·3 (22–23); ear from meatus, 15·5 (15–16). Average and extremes of ten adults from the Isle of Man: head and body, 95 (90–103); tail, 84 (75–93); hind foot, 22·2 (21–23); ear from meatus, 16 (15–17). Average and extremes of five adults from Cromarty, Scotland: head and body, 95·6 (92–101); tail, 87·2 (83–91); hind foot, 22·6 (21–23); ear from meatus, 16·8 (16–17). Average and extremes of ten adults from Wormsley, Oxfordshire: head and body, 96·5 (90–105); tail, 90·1 (79–99); hind foot, 22·1 (21–23). Average and extremes of six adults from Tresco, Scilly Islands, Cornwall: head and body, 95·5 (92–99); tail, 88 (83–96); hind foot, 22·2 (21–23); ear from meatus, 15·5 (15–16). Average and extremes of ten

adults from Bergen, Norway: head and body, 96·1 (89–107); tail, 98·3 (89–107); hind foot, 22·1 (21–22·6). Adult male and female from Upsala, Sweden: head and body, 95 and 93; tail, 89 and —; hind foot, 21 and 21. Average and extremes of ten adults from Waremme, Liége, Belgium: head and body, 94·3 (85–99); tail, 92·3 (85–99); hind foot, 22·0 (21–23). Average and extremes of ten adults from the Forest of Bouconne, Gers, France: head and body, 93·1 (87–101); tail, 85·5 (78–90); hind foot, 20·5 (20–21); ear from meatus, 15·2 (15–16). Average and extremes of ten adults from Brunswick, Germany: head and body, 94·3 (91–105); tail, 87·1 (81–94); hind foot, 21·3 (20–22). Average and extremes of seven adults from Gageni, Roumania: head and body, 93·0 (90–96); tail, 85·3 (81–91); hind foot, 21·5 (21–22); ear from meatus, 16·0 (15·5–17). Average and extremes of ten adults from Meiringen, Bern, Switzerland: head and body, 96·0 (93–99); tail, 93·7 (91–107); hind foot, 22·2 (21–23·4). Average and extremes of seven adults from Locarno, Ticino, Switzerland: head and body, 96 (92–101); tail, 97·4 (87–103); hind foot, 22·5 (21–23·6); ear from meatus, 16·1 (15–17). For cranial measurements see Table, p. 814.

Specimens examined.—Eight hundred and twenty-six, from the following localities:—

Iceland: Near Reykjavik, 6 (U.S.N.M.).

Ireland: Clandeboye, Down, 3; Co. Meath, 1; Woodpark, Co. Clare, 5; Scariff, Galway, 3; Clare Island, Co. Mayo, 6; Inishmore, Aran Islands, 4; Fermoyle, Clare, 4; Nenagh, Tipperary, 1; Cashel, Tipperary, 2; Ballaghmoon, Carlow, 6; Cappagh, Wexford, 1; Duncannon, Wexford, 3; Kilmanock, Wexford, 2; Caragh Lake, Kerry, 6 (including type of *celticus* Barrett-Hamilton); Castlegregory, Kerry, 4; Glencar, Leitrim, 1.

Scotland: Islay, 1; Skye, 1; Dunrossness, Shetland, 3; South Sutor, Cromarty, 7; Black Isle, Cromarty, 4; Craigellachie, Elgin, 1; Lossiemouth, Elgin, 2; Lhanbride, Elgin, 2; Dunphail, Elgin, 8; Tiree, 2; Kinloch, Rannoch, Perthshire, 2; Cortachy, Forfar, 3 (Wilson); Dalmeny Park, Edinburgh, 2; Beech Hill, Haddington, 1; Stockbriggs, Lanarkshire, 2; Wyseby, Dumfriesshire, 1.

England: Isle of Man, 36; Riding-Mill-on-Tyne, Northumberland, 1; Alnwick, Northumberland, 3; Filey, Yorkshire, 1; Grimsby, Lincolnshire, 3; Scole, Norfolk, 1; Cheadle, Staffordshire, 3; Swincliffe, Shropshire, 1; Swithland, Leicestershire, 12; Belvoir, Leicestershire, 2; Anglesey, 1; Aberia, Merionethshire, 2; Truoyn-y-peurleyn, Merionethshire, 2; Penrhyndeudraeth, Merionethshire, 1; Laugharne, Carmarthenshire, 4; Merlins Hill, Pembroke, 2; Southerndown near Bridgend, Glamorganshire, 10; Bishopstone, Herefordshire, 3; Graftonbury, Herefordshire, 14; Ledbury, Herefordshire, 1; Darsley, Gloucestershire, 3; Clifton, Gloucestershire, 7; Crippetts, Gloucestershire, 11 (Wilson); Wyre Forest, Worcestershire, 1; Rugby, Warwickshire, 2; Bloxham, Oxfordshire, 2; Wormsley, Oxfordshire, 18; Luton, Bedfordshire, 1; Oundle, Northamptonshire, 1; Colne, Cambridgeshire, 1; Histon, Cambridgeshire, 1; Fulbourn, Cambridgeshire, 3; Levesham, Suffolk, 2 (Wilson); Lowestoft, Suffolk, 4; Haileybury, Hertfordshire, 1; Tring, Hertfordshire, 1; Hillingdon, Middlesex, 1; Chiswick, Middlesex, 1; Regent's Park, London, 2; Banstead, Surrey, 18; Wandsworth Common, Surrey, 4; Betchworth, Surrey, 1; Yalding, Kent, 4; Crowborough, Sussex, 3; Dobbin Island, Pagham Harbour, Sussex, 1; Alum Bay, Isle of Wight, 4; Bembridge,

Isle of Wight, 3; St. Helen's, Isle of Wight, 1; Andover, Hampshire, 1; Basingstoke, Hampshire, 3; New Forest, Hampshire, 16; Monxton, Hampshire, 1; Blandford, Dorsetshire, 1; Colleigh, Honiton, Devonshire, 1; Combmartin, Devonshire, 1; Brent Knoll, Somersetshire, 1; Northlew, Devonshire, 3; Tresco, Scilly Islands, Cornwall, 6.

NORWAY: Near Bergen, 18 (B.M. and U.S.N.M.); Eggedal, 10 (U.S.N.M.); Aker, Christiania, 1; Asker, Christiania, 6 (U.S.N.M.).

SWEDEN: Upsala, 9 (B.M. and U.S.N.M.).

DENMARK: Hilleröd, Zealand, 2.

HOLLAND: Oosterbeek, Guelderland, 2; Noordwijk, near Leiden, 3; Leiden, 3 (U.S.N.M.).

BELGIUM: Esneux, Liége, 4; Waremme, Liége, 39 (U.S.N.M.).

FRANCE: Guines, Pas-de-Calais, 2; near Boulogne, Pas-de-Calais, 4; Trinity, Jersey, Channel Islands, 3; St. Martins, Guernsey, Channel Islands, 1; Alderney, Channel Islands, 6; Sark, Channel Islands, 1; Dinan, 7; Huelgoat, Finistère, 1; Barbizon, Seine-et-Marne, 1; Mt. Dore, Puy-de-Dôme, 3; Cadillac, Gironde, 27 (U.S.N.M.); Solférino, Landes, 9; Fôret de Bouconne, Gers, 14; Montréjeau, 11 (U.S.N.M.); Biarritz, Basses-Pyrénées, 7; St. Paul, near Barcelonnette, Basses-Alpes, 27; Chamonix, Haute-Savoie, 6 (U.S.N.M.); Cranves-Sales, Haute-Savoie, 8; Lucinges, Haute-Savoie, 6; Montauban, Haute-Savoie, 3; Étupes, Doubs, 4; Manonville, Meürthe-et-Moselle, 2.

GERMANY: Brunswick, 34 (U.S.N.M.); Hausbruch, Hanover, 2; Bodethal, Harz Mountains, 4 (U.S.N.M.); Bahrenberg, Harz Mountains, 4 (U.S.N.M.); Wolfshau, Riesengebirge, Silesia, 22 (U.S.N.M.); Eulengrund, near Schneekoppe, Silesia, 4 (U.S.N.M.); Niesky, Silesia, 7; Magdeburg, Saxony, 2; Marxheim, Bavaria, 5; Strass, near Burgheim, Bavaria, 3; Schwarzburg, 3; Kalbe, 1; Ingelheim, Rheinhessen, 2; Strassburg, 6.

AUSTRIA-HUNGARY: Haida, Bohemia, 2; Hainspach, Bohemia, 4 (U.S.N.M.); Csallóköz-Somorja, Pressburg, 2; Hatszeg, Hunyad, 3; Transylvania, 1; Eszek, Slavonia, 4.

ROUMANIA: Gageni, Prahova (at base of Carpathians, north-west of Bucharest), 7.

SWITZERLAND: Geneva, 7 (U.S.N.M.); St. Cergues, Vaud, 4 (U.S.N.M.); Les Plans, Vaud, 3 (U.S.N.M.); Zermatt, Valais, 1 (U.S.N.M.); Meiringen, Bern, 43 (U.S.N.M.); Brunig, Bern, 5 (U.S.N.M.); Lucerne, 3; Vitznau, 1 (U.S.N.M.); Göschenen, Uri, 2 (U.S.N.M.); Andermatt, Uri, 1 (U.S.N.M.); St. Gallen, 4 (U.S.N.M.); Murgthal, St. Gallen, 1 (U.S.N.M.); Sitterwald, St. Gallen, 5 (U.S.N.M.); Wildpark, St. Gallen, 1 (U.S.N.M.); Züberwangen, St. Gallen, 1 (U.S.N.M.); Wolfhalden, Appenzell, 5; Albulapass, Grisons, 5 (U.S.N.M.); Bergün, Grisons, 1 (U.S.N.M.); Vulpera-Tarasp, Grisons, 5 (Rothschild); Faido, Ticino, 3 (B.M. and U.S.N.M.); Lugano, Ticino, 6 (U.S.N.M.); Capolago, Ticino, 1; Locarno, Ticino, 7.

ITALY: Padola, Cadore, 1 (Turin).

2 ♂, 1 ♀.	Clandeboye, Down, Ireland.	W. R. Ogilvie-Grant (C & P).	11. 1. 3. 318–320.
1 al.	Meath.	Dr. G. E. Dobson (P).	80. 12. 14. 5.
3 ♂, 3 ♀.	Clare Island, Mayo. (*R. H. Bunting.*)	G. Barrett-Hamilton (P).	11. 1. 2. 132–137.
2 ♂, 2 ♀.	Inishmore, Aran Islands. (*R. H. Bunting.*)	G. Barrett-Hamilton (P).	11. 1. 2. 138–141.
3 ♂.	Scariff, Galway. (*R. F. Hibbert.*)	G. Barrett-Hamilton (P).	11. 1. 2. 68–70.
♂.	Clare. (*R. F. Hibbert.*)	G. Barrett-Hamilton (P).	11. 1. 2. 71.
♂.	Nenagh, Tipperary.	Capt. W. F. Smith (C & P).	11. 1. 3. 321.
♂.	Cashel, Tipperary.	W. E. de Winton (C & P).	11. 1. 3. 322.
2 ♂, 2 ♀.	Ballaghmoon, Carlow. (*J. G. Symes.*)	G. Barrett-Hamilton (P).	11. 1. 2. 64–67.

♂.	Cappagh, Waterford. (*W. J. Ussher.*)	G. Barrett-Hamilton (P).	11. 1. 2. 72.
2 ♂.	Kilmanock, Wexford. (*Connell.*)	G. Barrett-Hamilton (P).	11. 1. 2. 62–63.
♀.	Kerry.	Col. J. W. Yerbury (C & P). (*Type* of *celticus* Barr.-Ham.)	0. 3. 11. 1.
2 ♂, ♀.	Caragh Lake, Kerry.	Col. J. W. Yerbury (C & P).	11. 1. 3. 323-325.
1 al.	Islay, Scotland.	H. Russell (C & P).	9. 9. 11. 4.
♂, ♀.	Tiree Island. (*P. Anderson.*)	Lord Elphinstone (P).	8. 3. 16. 1–2.
♀.	Isle of Skye.	J. S. Elliott (C & P).	11. 1. 3. 315.
2 ♂, ♀.	South Sutor, Cromarty.	W. R. Ogilvie-Grant (C & P).	11. 1. 3. 303–305.
♂, ♀.	Black Isle, Cromarty.	W. R. Ogilvie-Grant (C & P).	11. 1. 3. 301–302.
2 ♂.	Lossiemouth, Elgin.	G. Denoon (C & P).	11. 1. 3. 312–313.
♀ al.	Craigellachie, Elgin.	J. E. Harting (C & P).	89. 5. 17. 1.
2 ♂, 2 ♀.	Dunphail, Elgin.	W. R. Ogilvie-Grant (C & P).	11. 1. 3. 306–309.
♂, ♀.	Lhanbride, Elgin.	W. Taylor (C & P).	11. 1. 3. 310–311.
2 ♂.	Dalmeny Park, Edinburgh.	W. Evans (C & P).	11. 1. 3. 316–317.
♂.	Stockbriggs, Lanarkshire.	E. R. Alston (C & P).	79. 9. 25. 60.
2 ♂, ♀.	Ramsay, Isle of Man.	C. H. B. Grant (C & P).	11. 1. 3. 346–348.
3 ♂.	Selby Bridge, Isle of Man.	C. H. B. Grant (C & P).	11. 1. 3. 349–351.
2 ♂, 2 ♀.	Swithland, Leicestershire, England.	F. A. Butler (C & P).	11. 1. 3. 361–364.
♂, ♀ al.	Belvoir, Leicestershire.	F. T. Mott (C & P).	85. 5. 5. 1–2.
1 al.	Swincliffe, Shropshire.	A. Smith (C & P).	74. 11. 25. 3.
2 ♂.	Aberia, Merionethshire, Wales.	G. H. Caton-Haigh (C & P).	11. 1. 3. 326–327.
2 ♂, 2 ♀.	Laugharne, Carmarthenshire.	W. E. de Winton (C & P).	11. 1. 3. 328–331.
4 ♂.	Bridgend, Glamorganshire.	R. I. Pocock (C & P).	11. 1. 3. 332–335.
♂, 4 ♀.	Graftonbury, Herefordshire, England.	W. E. de Winton (C & P).	11. 1. 3. 370–374.
3 al.	Bishopstone, Herefordshire.	Rev. S. O. Ridley (C & P).	81. 1. 1. 1–3.
♂.	Bloxham, Oxfordshire.	O. V. Aplin (C & P).	11. 1. 3. 369.
2 ♂, 2 ♀.	Wormsley, Oxfordshire.	W. R. Ogilvie-Grant (C & P).	11. 1. 3. 365–368.
3 ♂, ♀.	Yalding, Kent.	W. R. Ogilvie-Grant (C & P).	11. 1. 3. 352–355.
♀.	Chiswick, Middlesex.	Miss Sharpe (C & P).	11. 1. 3. 356.
9 ♂, 2 ♀.	New Forest, Hampshire.	Miller Collection.	7. 7. 7. 2887–2890, 2891–2902.
3 ♂.	Basingstoke, Hampshire.	Miller Collection.	7. 7. 7. 2903–2905.
3.	Clifton, Gloucestershire.	Miller Collection.	7. 7. 7. 3601–3603.
2 ♂, ♀.	Clifton ,,	R. I. Pocock (C & P).	11. 1. 3. 342–344.
♀.	Clifton ,,	R. Powell (P).	11. 1. 3. 345.
3 ♂, ♀.	Lowestoft, Suffolk.	O. Thomas (C & P).	11. 1. 3. 357–360.
♂.	Dobbin Island, Sussex, England. (*J. E. Harting.*)	E. R. Alston (P).	79. 9. 25. 41.
4 ♂, 2 ♀.	Scilly Islands, Cornwall, England.	F. J. Cox (C & P).	11. 1. 3. 336–341.
♀.	Brent Knoll, Somerset.	A. B. Percival (P).	3. 12. 17. 1.
3 ♂, ♀.	Opheim, Bergen, Norway.	Miller Collection.	7. 7. 7. 4464–4467.

1.	Aker, Christiania, Norway.	Christiania Museum (E).	93. 3. 1. 10.
♀.	Upsala, Sweden. (*Kolthoff.*)	Lord Lilford (P).	11. 1. 1. 163.
2 ♀.	Hilleröd, Zealand, Denmark.	O. Thomas (C & P).	98. 6. 7. 11–12.
♂, ♀.	Oosterbeek, Guelderland, Holland.	O. Thomas (C & P).	98. 2. 1. 16–17.
♂, 2 ♀.	Noordwijk, Leiden, Holland.	O. Thomas (C & P).	98. 2. 1. 18–20.
♂, 8 ♀.	Esneux, Liége, Belgium. (*H. Grönvold.*)	Lord Lilford (P).	95. 1. 1. 12–20.
♂, ♀.	Guines, Pas-de-Calais, France.	O. Thomas (C & P).	94. 6. 6. 14–15.
2 ♂, 2 ♀.	Boulogne, Pas-de-Calais.	O. Thomas (C & P).	98. 1. 9. 12–15.
4 al.	Alderney, Channel Islands.	W. Eagle Clarke (C & P).	98. 9. 29. 3–6.
2 ♂.	Alderney, Channel Islands. (*W. Eagle Clarke.*)	G. Barrett-Hamilton (P).	11. 1. 2. 73–74.
2 ♂.	Trinity, Jersey, Channel Islands. (*R. H. Bunting.*)	O. Thomas (P).	8. 9. 2. 10–11, 23.
♂.	Sark, Channel Islands. (*G. F. Derrick.*)	Guernsey Society of Natural Science (P).	10. 2. 27. 1.
4 ♂, 4 ♀.	Dinan, Brittany.	G. Barrett-Hamilton (P).	11. 1. 2. 115–122.
♀.	Huelgoat, Brittany.	O. Thomas (C & P).	92. 9. 5. 2.
6 ♂, 3 ♀.	Solférino, Landes. (*A. Robert.*)	O. Thomas (P).	6. 4. 1. 66–74.
5 ♂, 2 ♀.	Forêt de Bouconne, Gers, 250 m. (*A. Robert.*)	O. Thomas (P).	6. 4. 1. 59–65.
2 ♂, 2 ♀.	Cranves-Sales, Haute-Savoie, 900 m.	A. Robert (C & P).	5. 4. 4. 2–5.
3 ♂.	Cranves-Sales, Haute-Savoie. (*A. Robert.*)	O. Thomas (P).	5. 11. 18. 11–13.
8 ♂, 8 ♀.	Barcelonnette, Basses-Alpes. (*C. Mottaz.*)	O. Thomas (P).	8. 8. 10. 74–89.
♂.	Barbizon.	G. S. Miller (C).	8. 8. 4. 199.
2 ♂, ♀.	Mt. Dore, Puy-de-Dôme.	G. S. Miller (C).	8. 8. 4. 210–212.
4 ♂, 3 ♀.	Biarritz, Basses-Pyrénées.	J. F. Davison (C & P).	6. 6. 4. 3–9.
3.	Niesky, Silesia, Germany. (*W. Baer.*)	Lord Lilford (P).	99. 1. 9. 17–18.
♂, 3 ♀.	Niesky, Silesia. (*W. Baer.*)	Dr. E. Hamilton (P).	97. 12. 4. 21–24.
2.	Magdeburg, Saxony.	Dr. W. Wolterstorff (C & P).	92. 12. 1. 8–9.
♂.	Magdeburg, Saxony. (*Wolterstorff.*)	Lord Lilford (P).	11. 1. 1. 158.
2 ♀.	Marxheim, Bavaria. (*Wolterstorff.*)	Lord Lilford (P).	11. 1. 1. 161–162.
♂, ♀.	Strass, Burgheim, Bavaria. (*Körbitz.*)	Lord Lilford (P).	11. 1. 1. 159–160.
2 ♂, ♀.	Schwarzburg. (*W. Schlüter.*)	Lord Lilford (P).	95. 4. 18. 12–14.
♂.	Kalbe, Germany. (*Wolterstorff.*)	Lord Lilford (P).	11. 1. 1. 157.
2 ♀.	Ingelheim, Rheinhessen.	C. Hilgert (C).	8. 11. 2. 44–45
4 ♂, 2 ♀.	Strassburg, Alsace. (*C. Mottaz.*)	O. Thomas (P).	8. 8. 10. 139–144.
2.	Csallóköz-Somorja, Pressburg, Hungary.	Budapest Museum (E).	94. 3. 1. 46–47.

♂, 2 ♀. Hatszeg, Hunyad, Transylvania.	C. G. Danford (c).	3. 2. 2. 25, 30, 32.
1 al. Transylvania.	C. G. Danford (p).	80. 10. 28. 1.
4 al. Eszek, Slavonia.	Budapest Museum (e).	94. 7. 23. 2–5.
4 ♂, 4 ♀. Gageni, Prahova, Roumania. (*W. Dodson.*)	Lord Lilford (p).	4. 4. 6. 17–24.
4 ♂, ♀. Wolfhalden, Switzerland. (*Zollikofer.*)	Miller Collection.	7. 7. 7. 10–14.
♀. Capolago, Ticino.	O. Thomas (c & p).	2. 7. 1. 6.
3 ♂, 3 ♀. Locarno, Ticino.	O. Thomas (c & p).	2. 7. 1. 7–12.
♂. Faido, Ticino.	O. Thomas (c & p).	2. 7. 1. 19.
3 ♂. Lucerne, Switzerland. (*Wolterstorff.*)	Lord Lilford (p).	11. 1. 1. 154–156.

Apodemus sylvaticus callipides Cabrera.

1907. *Micromys sylvaticus callipides* Cabrera, Bol. Real Soc. Españ. Hist. Nat., Madrid, vii, p. 227, November, 1907 (Villarrutis, La Coruña, Spain). Type in Madrid Museum.

1910. *Mus sylvaticus callipides* Trouessart, Faune Mamm. d'Europe, p. 153.

Type locality.—Villarrutis, La Coruña, Spain.

Geographical distribution.—Mountains of the Pyrenees-Asturias chain; southward into Portugal.

Diagnosis.—Size distinctly larger than in *Apodemus sylvaticus sylvaticus*, the hind foot most frequently 23 mm., condylobasal length of skull usually 23·6 mm. or more; colour dark and rich as in the typical form.

Measurements.—Type, adult male (from Cabrera): head and body, 88·8; tail, 94·5; hind foot, 23. Adult male and female from Cintra, Portugal: head and body, 100 and 100; tail, 107 and 100; hind foot, 24·8 and 24; ear from meatus, 17 and 17. Adult male from Estoril, Portugal: head and body, 101; tail, 103; hind foot, 23·3; ear from meatus, 16·2. Average and extremes of ten adults from Pajáres, Leon, Spain: head and body, 100·3 (91–110); tail, 92·3 (80–104); hind foot, 23·0 (22–24); ear from meatus, 17·2 (16–18). Average and extremes of eight adults from the vicinity of Luchon, Haute-Garonne, France: head and body, 98·7 (98–100); tail, 102·5 (90–115); hind foot, 22·7 (22–24); ear from meatus, 17·1 (16–18). Average and extremes of ten adults from Ax-les-Thermes, Ariège, France: head and body, 98·2 (94–105); tail, 100·8 (90–110); hind foot, 22·7 (22–23·6). For cranial measurements see Table, p. 819.

Specimens examined.—One hundred and twelve, from the following localities:—

France: Porté, Pyrénées-Orientales, 9; l'Hospitalet, Ariège, 8; Ax-les-Thermes, Ariège, 31; Luchon, Haute-Garonne, 11; Caterille, Haute-Garonne, 5; Barèges, Hautes-Pyrénées, 19; Pic-du-Midi, Hautes-Pyrénées, 1.

Spain: Pajáres, Leon, 10; La Coruña, 2; Villalba, Lugo, 5.

Portugal: Cintra, 7; Estoril, 2; Oporto, 1.

4 ♂. Porté, Pyrénées-Orientales, France.	G. S. Miller (c).	8. 8. 4. 200–203.
♂, ♀. Porté, Pyrénées-Orientales; 16–1700 m. (*A. Robert.*)	O. Thomas (p).	8. 9. 1. 57–57.

5 ♂, ♀.	L'Hospitalet, Ariège.	G. S. Miller (c).	8. 8. 4. 204–209.
♂, ♀.	L'Hospitalet, Ariège. (*A. Robert.*)	O. Thomas (p).	8. 9. 1. 54–55.
4 ♂, 4 ♀.	Ax-les-Thermes, Ariège.	G. S. Miller (c).	8. 8. 4. 213–220.
5 ♂, 3 ♀.	Luchon, Haute-Garonne. (*A. Robert.*)	O. Thomas (p).	6. 4. 1. 40–47.
3 ♂, 2 ♀.	Caterille, Haute-Garonne. (*A. Robert.*)	O. Thomas (p).	6. 4. 1. 54–58.
3 ♂, 4 ♀.	Barèges, Hautes-Pyrénées.	G. S. Miller (c).	8. 8. 4. 183–189.
♂.	Pic-du-Midi, Hautes-Pyrénées. (*A. Robert.*)	O. Thomas (p).	8. 9. 1. 58.
3 ♂, 5 ♀.	Pajáres, Leon, Spain. (*N. Gonzalez.*)	O. Thomas (p).	8. 2. 9. 110–117.
2 al.	Coruña.	D. V. L. Seoane (c & p).	94. 3. 19. 1–2.
5 al.	Villalba, Lugo.	Dr. V. L. Seoane (c & p).	94. 1. 1. 10–13. 95. 4. 29. 2.
2 ♂, 2 ♀.	Cintra, Portugal.	O. Thomas (c & p).	98. 2. 2. 22–25.
♂, ♀, 1.	Cintra. (*K. Jordan.*)	Hon. N. C. Rothschild (p).	10. 9. 28. 1–3.
2 ♂.	Estoril.	O. Thomas (c & p).	98. 2. 2. 26–27.
♀.	Oporto. (*J. Searle.*)	Lord Lilford (p).	11. 1. 1. 164.

Apodemus sylvaticus dichrurus Rafinesque.

1814. *Musculus dichrurus* Rafinesque, Précis des Découvertes Somiologiques, p. 13 (Sicily).

1844. *Mus pecchioli* Pecchioli, Atti della quinta Unione degli Scienziati Italiani, Torino, 1843, p. 426 (Tuscany, probably vicinity of Siena, Italy).

1900. *Mus sylvaticus hayi* Barrett-Hamilton, Proc. Zool. Soc., London, p. 410 (part).

1910. *Mus sylvaticus hayi* and *M. sylvaticus dichrurus* Trouessart, Faune Mamm. d'Europe, p. 154.

Type locality.—Sicily.

Geographical distribution.—Mediterranean region from the Balkan Peninsula to central and southern Spain.

Diagnosis. Size as in *Apodemus sylvaticus callipides*, but colour differing from that of the other continental European races in a general pallor and dulness resulting from the suppression of reddish tints and the predominance of yellow and grey.

Colour.—Typical specimens from Sicily have the ground colour of back a very uniform dull buffy wood-brown, slightly darker along median posterior region, and slightly more greyish anteriorly, the black hair tips, though numerous, nowhere sufficiently abundant to produce any evident effect of clouding; sides faintly paler and more buffy, the lower portion of cheek and outer surface of front leg nearly clear buff as in true *sylvaticus*; underparts dull white; pectoral spot slightly developed and rarely forming a collar; tail rather less evidently bicolor than in the central European form. Grey extreme: ground colour above a peculiar buffy grey, intermediate between the cerus-drab and cream-buff of Ridgway, but paler than either, the "lining" produced by the black hairs conspicuous. Yellow

extreme: ground colour a clear buff slightly more yellowish than that of Ridgway, fading nearly to cream-buff on head and neck, the black "lining" conspicuous and tending to produce a clouded effect along middle of back.

All of the Italian skins examined * are essentially like the typical Sicilian specimens. The same is true of the majority of those from Spain; but in this series occur also the extremes of yellowness and greyness. The skins from Corfu and Cephalonia are about typical, while those from the mainland of Greece show a decided tendency toward the yellow extreme.

Measurements.—Adult male and female from Palermo, Sicily: head and body, 100 and 102; tail, 93 and 91; hind foot, 23 and 22. Average and extremes of five adults from Sorrento, Italy: head and body, 100·8 (99–104); tail, 94·6 (90–99); hind foot, 21·9 (21–23). Average and extremes of seven adults from Genoa, Italy: head and body, 102·8 (92–109); tail, 87 (80–95); hind foot, 22 (21–23). Adult male and female from Corfu, Greece: head and body, 98 and 100; tail, 100 and 97; hind foot, 22 and 21·5; ear from meatus, 16·7 and 17. Adult male and female from Cephalonia, Greece: head and body, 101 and 100; tail, 99 and 98; hind foot, 23 and 21; ear from meatus, 17·2 and 16·4. Adult male and female from Tatoi, near Athens, Greece: head and body, 101 and 100; tail, 106 and 106; hind foot, 23·4 and 21·8; ear from meatus, 16·2 and 16·3. Three adult males from Valescure, Var, France: head and body, 104, 105 and 106; tail, 107, 100 and 108; hind foot, 23·4, 22·4 and 23; ear from meatus, 18·2, 17·4 and 17. Average and extremes of ten adults from the vicinity of Nîmes, Gard, France: head and body, 104·2 (98–110); tail, 97·9 (93–105); hind foot, 22·9 (21·6–24·3); ear from meatus, 16·3 (15–17·6). Four adult males from Silos, Burgos, Spain: head and body, 97, 98, 101 and 102; tail, 92, 88, 99 and 105; hind foot, 22, 23, 23·2 and 23; ear from meatus, 18·6, 17, 17 and 17. Average and extremes of eight adults from the Province of Granada, Spain (Guadix and Venta del Baul): head and body, 105·8 (100–113); tail, 109·5 (100–128); hind foot, 24·1 (21·4–25); ear from meatus, 17·5 (16·5–19). Average and extremes of ten adults from the Province of Alicante, Spain (Elche and Alcoy): head and body, 104·4 (100–107); tail, 103·2 (92–109); hind foot, 23·2 (21–24); ear from meatus, 18·3 (17–19). For cranial measurements see Table, p. 820.

Specimens examined.—Two hundred and seventy-three, from the following localities:—

Spain: Guadix, Granada, 5; Venta del Baul, Granada, 11; Elche, Alicante, 8; Alcoy, Alicante, 3; Dehesa de Valencia, 3; Barracas, Castellon, 1; Villalba, Madrid, 9; Béjar, Salamanca, 10; Silos, Burgos, 20;

* Except those from the vicinity of Turin, which somewhat approach true *sylvaticus*.

Castrillo de la Reina, Burgos, 1; Panticosa, Huesca, 4; Jaca, Huesca, 1; Jerez, Cadiz, 1; Inca, Majorca, Balearic Islands, 12; San Cristobal, Minorca, Balearic Islands, 6.

FRANCE: Cerbère, Pyrénées-Orientales, 1; near Nîmes, Gard, 21; Valescure, Var, 11; Agay, Var, 1.

ITALY: Vicinity of Turin, 19 (Turin); Moncalieri, Turin, 6 (B.M., U.S.N.M. and Turin); Genoa, 11 (U.S.N.M.); Viareggio, 4; Sorrento, 12 (B.M. and U.S.N.M.); Aspromonte, Lagonegro, 2; Monte Sirino, 1.

SICILY: Acicastello, 1 (U.S.N.M.); Castelbuono, 4; Ficuzza, 5; Madonna dell'Alto, 8; Marsala, 4; Palermo, 5 (U.S.N.M.); San Giuglielmo, 4; Taormina, 4 (U.S.N.M.).

CORSICA: Asco, 2; La Foce di Vizzavona, 2; no exact locality, 3.

MONTENEGRO: No exact locality, 2.

ALBANIA: Northern Albania, 2.

GREECE: Corfu, 9; Cephalonia, 13; Patras, 1; near Athens, 15; Agorianni, 5 (U.S.N.M.).

4 ♂, 1 ♀.	Guadix, Granada, Spain.	G. S. Miller (C).	8. 8. 4. 75–79.
4 ♂, 3 ♀.	Venta del Baul, Granada.	G. S. Miller (C).	8. 8. 4. 80–86.
2 ♂.	Elche, Alicante.	G. S. Miller (C).	8. 8. 4. 87–88.
♂, 2 ♀.	Alcoy, Alicante. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 127–129.
4 ♂.	Villalba, Madrid. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 122–125.
4 ♂, 3 ♀.	Béjar, Salamanca. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 103–109.
7 ♂, ♀.	Silos, Burgos.	G. S. Miller (C).	8. 8. 4. 66–73.
♀.	Castrillo, Burgos.	G. S. Miller (C).	8. 8. 4. 74.
4 ♂.	Panticosa, Huesca. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 118–121.
♂.	Jaca, Huesca. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 126.
♀.	Jerez, Cadiz.	Abel Chapman (C & P).	8. 3. 26. 5.
3 ♂, 6 ♀.	Inca, Majorca, Balearic Islands.	O. Thomas and R. I. Pocock (C & P).	0. 7. 1. 9–17.
4 ♂, 2 ♀.	San Cristobal, Minorca.	O. Thomas and R. I. Pocock (C & P).	0. 7. 1. 52–57.
♂. juv.	Cerbère, Pyrénées Orientales, France.	O. Thomas and R. I. Pocock (C & P).	0. 7. 1. 75–76.
4 ♂, 4 ♀.	Nîmes, Gard. (*C. Mottaz.*)	O. Thomas (P).	8. 8. 10. 66–73.
4 ♂, 3 ♀.	Valescure, Var.	G. S. Miller (C).	8. 8. 4. 190–197.
♀.	Agay, Var.	G. S. Miller (C).	8. 8. 4. 198.
♂, ♀.	Moncalieri, Turin, Italy.	Dr. E. Festa (P).	8. 8. 1. 1–2.
4 ♂.	Viareggio.	O. Thomas (C & P).	5. 8. 3. 2–5.
2 ♂, 2 ♀.	Sorrento.	R. J. Cuninghame (C & P).	98. 5. 2. 12–15.
2 ♂.	Aspromonte, Calabria. (*A. Robert.*)	O. Thomas (P).	6. 8. 4. 6–7.
♂.	Monte Sirino, Calabria. (*A. Robert.*)	O. Thomas (P).	6. 8. 4. 8.
3 ♂, ♀.	Castelbuono, Sicily. (*A. Robert.*)	O. Thomas (P).	6. 8. 4. 42–43. 8. 9. 1. 24–25.
5 ♂.	Ficuzza, Sicily. (*A. Robert.*)	O. Thomas (P).	6. 8. 4. 39–41. 8. 9. 1. 22–23.
5 ♂, 3 ♀.	Madonna dell' Alto, Petralia, Sicily. (*A. Robert.*)	O. Thomas (P).	8. 9. 1. 10–17.
2 ♂, 2 ♀.	Marsala, Sicily. (*A. Robert.*)	O. Thomas (P).	6. 8. 4. 35–38.
3 ♂, ♀.	San Giuglielmo, Sicily. (*A. Robert.*)	O. Thomas (P).	8. 9. 1. 18–21.

♂, ♀.	Asco, Corsica. (*Dr. F. Major.*)	O. Thomas (P).	8. 11. 30. 7-8.
2.	La Foce di Vizzavona, Corsica.	Col. J. W. Yerbury (P).	93. 9. 15. 4-5.
3 al.	Corsica.	Col. J. W. Yerbury (P).	93. 9. 15. 6-8.
2 ♂.	Montenegro. (*L. Führer.*)	O. Thomas (P).	5. 8. 4. 16-17.
♂, ♀.	North Albania. (*L. Führer.*)	O. Thomas (P).	5. 8. 4. 36, 37.
♂.	Potamos, Corfu, Greece.	J. I. S. Whitaker (P).	8. 10. 1. 10.
♂.	Cephalonia.	C. Mottaz (C).	8. 11. 3. 11.
8 ♂, 4 ♀.	Cephalonia. (*C. Mottaz.*)	J. I. S. Whitaker (P).	8. 10. 1. 11-22.
♂.	Itaci, Athens. (*C. Mottaz.*)	Hon. N. C. Rothschild (P).	8. 10. 2. 26.
4 ♀.	Tatoi, Athens. (*C. Mottaz.*)	Hon. N. C. Rothschild (P).	8. 10. 2. 33-36.
♀.	Kephissia, Athens. (*C. Mottaz.*)	Hon. N. C. Rothschild (P).	8. 10. 2. 37.

Apodemus sylvaticus creticus Miller.

1910. *Apodemus sylvaticus creticus* Miller, Ann. and Mag. Nat. Hist., 8th ser., VI, p. 460, November, 1910.

Type locality.—Katharo, Crete.

Geographical distribution.—Island of Crete.

Diagnosis.—Size small, essentially as in true *A. sylvaticus*, but colour paler and more yellowish.

Colour.—Ground colour of upper parts a clear, light, yellowish cream-buff without greyish tinge, except occasionally on crown and neck, scarcely different on sides away from line of demarcation, where it becomes slightly more yellowish; back heavily "lined" with black, this diminishing rather abruptly on sides. Underparts and feet white, the region from interramia to base of tail dulled by the blackish-slate undercolour. Tail sharply bicolor, dark brown above, white below. Ear dark brown sprinkled with silvery hairs which tend to form a narrow, faintly defined whitish edging.

Skull and teeth.—The skull and teeth are smaller than in the other Mediterranean forms, but are not certainly distinguishable from those of *A. sylvaticus sylvaticus*.

Measurements.—Type (adult female): head and body, 88; tail, 88; hind foot, 21; ear from meatus, 17. Average and extremes of six adults from Katharo and Kania, Crete: head and body, 84·6 (80–88); tail, 87·8 (86–89); hind foot, 21·5 (21–22); ear from meatus, 16·5 (16–17). For cranial measurements see Table, p. 823.

Specimens examined.—Six, all from the island of Crete (two from Kanea, the others from Katharo).

Remarks.—The Cretan form of *Apodemus sylvaticus* combines the small size of the typical race with the dull yellowish colour of *A. sylvaticus dichrurus*.

2 ♂, 2 ♀.	Katharo, Crete.	Miss D. Bate (C).	5. 12. 2. 25-28. (5. 12. 2. 27. *Type* of subspecies.)
♂, ♀.	Kanea.	Miss D. Bate (C).	5. 12. 2. 29-30.

CRANIAL MEASUREMENTS OF *APODEMUS SYLVATICUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Breadth of brain-case.	Depth of brain-case at middle.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
A. sylvaticus sylvaticus.													
Iceland: Reykjavik	155640	♂	24·0	13·4	4·2	12·0	8·0	9·2	7·0	14·8	4·0	3·8	Teeth moderately worn.
,,	155645	♂	23·4	13·0	4·2	11·4	7·8	8·8	6·8	14·6	4·0	4·0	,, ,,
Ireland: Cashel, Tipperary		♂	23·2	12·2	4·2	11·4	7·8	9·2	7·0	14·2	3·8	3·4	,, ,,
Carlow	11. 1. 2. 65	♂	23·8	13·0	4·0	11·4	7·6	9·6	7·0	15·2	4·0	3·8	,, ,,
,,	11. 1. 2. 64	♂	23·2	12·8	4·0	11·2	7·6	9·0	6·8	14·2	3·8	3·6	,, ,,
Nenagh	11. 1. 3. 321	♂	23·6	—	4·0	11·8	7·8	9·8	7·0	14·8	3·8	3·8	,, ,,
Woodpark, Clare	11. 1. 2. 71	♂	22·6	12·8	4·2		—	9·8	6·4	14·2	3·8	3·8	,, ,,
Glencar, Leitrim		♀	22·8	12·8	4·0	11·4	7·8	9·6	6·8	14·0	3·8	3·6	,, ,,
Scarif, Galway	11. 1. 2. 70	♀	22·8	12·6	4·2	11·2	7·6	9·0	6·4	14·0	4·0	3·8	,, ,,
,, ,,	11. 1. 2. 69	♀	22·0	12·2	4·0	11·0	7·6	8·8	6·0	13·6	3·8	3·6	,, ,,
,, ,,	11. 1. 2. 68	♂	22·6	12·8	4·0	11·0	7·4	9·4	6·8	14·2	3·8	3·6	,, ,,
Clandeboye	153279	♀	22·8	13·0	4·2	11·6	7·6	9·8	6·8	14·0	3·6	3·4	,, much worn.
Scotland: Cromarty	153282	♂	23·4	13·2	4·0	11·8	7·8	9·8	7·0	14·2	3·8	3·6	,, ,,
,,	153283	♀	22·8	13·0	4·0	11·4	8·0	9·4	7·0	14·6	3·8	3·6	,, ,,
Kinloch, Rannoch	11. 1. 3. 337	♀	23·4	12·6	4·2	11·8	8·0	9·0	7·4	15·0	3·8	3·6	,, ,,
,, ,,	Cox 3	♀	23·8	12·8	4·2	12·0	8·0	9·0	7·2	14·8	3·8	3·8	,, slightly worn.
Dalmeny Park, Edinburgh	11. 1. 3. 316	♂	22·6		4·0	11·0	7·2	8·8	6·8	13·6	3·8	3·6	,, moderately worn.
,, ,,	11. 1. 3. 317	♂	23·6	—	4·0	11·4	7·6	9·2	7·2	14·6	4·0	3·8	,, ,,
England: Clifton, Gloucestershire	11. 1. 3. 342	♂	23·2	13·0	4·0	11·0	8·0	10·0	6·6	14·2	4·2	3·8	,, ,,
,, ,,	11. 1. 3. 345	♀	23·0	12·8	4·0	11·2	8·0	8·8	6·8	14·2	3·8	3·6	,, much worn.

England: Anglesey	Coward c. 111	♂	23·8	—	4·2	10·8	8·2	9·6	7·2	14·8	4·0	4·0	Teeth much worn.
Merionethshire	153284	♂	23·2	13·2	4·2	11·8	8·4	9·4	6·8	14·8	4·0	3·8	,, moderately worn.
Bridgend, Glamorganshire		♂	23·8	13·0	4·0	11·2	8·0	9·8	7·2	14·8	3·6	3·2	,, much worn.
,, ,,		♂	23·2	—	4·0	11·6	8·2	9·0	7·0	14·0	3·6	3·4	,, moderately worn.
,, ,,	153285	♂	23·8	13·2	3·8	11·6	8·0	—	6·8	14·0	3·8	3·6	,, slightly worn.
,, ,,	153286	♀	23·4	—	4·2	—	8·2	9·2	6·8	14·2	3·8	3·6	,, much worn.
Graftonbury, Herefordshire	153289	♂	23·6	13·0	4·2	11·6	8·0	9·6	7·0	14·8	3·8	3·8	,, moderately worn.
,, ,,	153290	♂	22·4	12·8	4·2	11·6	8·0	9·0	6·4	14·2	3·8	3·6	,, slightly worn.
Swithland, Leicestershire	11. 1. 3. 410	♂	24·0	13·0	4·2	11·6	8·0	—	7·2	14·6	3·8	3·6	,, much worn.
,, ,,	153287	♂	22·8	—	4·2	11·8	7·6	9·2	7·0	14·2	3·8	3·6	,, moderately worn.
Lowestoft, Suffolk	11. 1. 3. 347	♂	24·0	13·2	4·0	12·2	8·4	9·6	7·2	14·4	4·0	3·8	,, much worn.
Chiswick, Middlesex	11. 1. 3. 356	♀	22·2	12·2	4·0	11·0	7·2	9·0	6·8	14·2	3·6	3·2	,, ,,
Wandsworth Common, Surrey	C. H. B. Grant 239	♂	23·8	13·2	4·2	11·2	8·0	9·4	7·2	14·2	4·0	3·8	,, ,,
Monxton, Hampshire	C. H. B. Grant 328	♂	23·4	12·4	4·0	11·0	8·0	8·4	6·8	14·2	4·0	3·8	,, moderately worn.
Isle of Wight	153292	♀	21·6	11·8	4·0	11·0	7·6	8·6	6·2	13·8	3·8	3·8	,, slightly worn.
,,	153293	♂	22·2	12·2	4·0	11·4	7·6	8·0	6·4	13·4	3·8	3·8	,, ,,
Northlew, Devonshire	153291	♂	22·4	12·6	4·0	11·6	7·2	9·0	6·4	14·0	3·8	3·6	,, ,,
Scilly Islands	11. 1. 3. 337	♂	24·4	13·2	4·2	11·8	8·8	10·2	7·2	15·2	4·0	3·8	,, much worn.
,,	11. 1. 3. 338	♂	24·2	13·0	4·2	11·8	8·2	10·0	7·0	15·0	3·8	3·8	,, moderately worn.
,,	11. 1. 3. 339	♂	24·2	13·0	4·2	11·8	8·2	10·0	7·2	15·2	4·0	3·8	,, much worn.
,,	11. 1. 3. 340	♀	24·0	12·6	4·2	11·6	8·0	10·0	7·0	14·8	4·0	3·8	,, moderately worn.
Norway: Bergen	84695	♂	23·4	12·8	4·0	11·8	7·4	9·4	7·0	15·0	3·8	3·8	,, much worn.
,,	84698	♂	23·0	12·6	4·0	11·8	7·8	9·4	7·0	14·6	3·6	3·4	,, moderately worn.
,,	84703	♂	22·6	12·6	4·0	11·0	7·8	8·8	6·8	14·0	3·8	3·6	,, ,,
,,	84705	♂	23·6	12·8	4·0	11·2	8·0	9·2	7·2	14·4	3·8	5·6	,, much worn.
,,	84706	♂	22·8	12·2	4·0	11·4	7·6	9·2	7·2	14·2	3·8	3·8	,, ,,
,,	84707	♂	24·2	13·2	4·2	12·0	8·2	10·0	7·2	14·8	3·8	3·4	,, moderately worn.

CRANIAL MEASUREMEMTS OF *APODEMUS SYLVATICUS—continued.*

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Breadth of brain-case.	Depth of brain-case at middle.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
A. sylvaticus sylvaticus—*contd.*													
Norway: Bergen	84694	♀	23·2	12·8	4·0	11·2	7·8	9·2	7·2	14·2	3·8	3·6	Teeth much worn.
,,	84697	♀	22·6	12·6	4·0	11·2	8·0	8·8	6·8	13·8	3·8	3·6	,, moderately worn.
,,	84700	♀	23·8	13·2	4·2	11·4	7·8	9·4	6·8	14 6	3·8	3·6	,, much worn.
,,	84708	♀	22·8	12·8	4·0	11·4	7·6	9·6	7·2	14·6	3·6	3·6	,, ,,
,,	84710	♀	22·8	12·0	4·0	11·0	7·8	8·8	7 0	14·2	3·6	3·4	,, moderately worn.
Sweden: Upsala	85064	♀	22·8	12·8	4·0	11·6	8·0	8·6	6·6	14·0	3·8	3·6	,, much worn.
Denmark: Hilleröd, Zealand	98. 6. 7. 12	♀	23±	13·0	4·0	11·2	—	9·6	6·8	14·2	4·0	3·6	,, moderately worn.
Holland: Oosterbeek, Guelderland	98. 2. 1. 16	♂	23·0	12·2	4·0	11·6	7·8	9·6	7·0	13·8	3·8	3·4	,, much worn.
,, ,,	98. 2. 1. 17	♀	22·6	12·2	4·0	11·4	8·0	9·4	6·8	14·0	3·8	3·6	,, slightly worn.
Belgium: Waremme, Liége	85986	♂	22·0	12·2	4·0	11·6	7·8	9·0	6·2	13·4	4·0	3·6	,, ,,
,, ,,	85990	♀	22 2	12·8	4·0	11·2	7·6	9·2	6·4	13·6	3·8	3·6	,, ,,
,, ,,	85991	♀	23·2	12·4	4·0	11·2	7·2	9·2	7·0	13·6	3·8	3·6	,, moderately worn.
,, ,,	85993	♀	22·2	12·0	4·0	11·2	7·4	9·0	6·4	13·2	3·8	3·8	,, slightly worn.
Esneux	95. 1. 1. 15	♀	23·0	13·2	4·0	11·8	7·8	9·6	6·8	14·6	4·0	3·6	,, ,,
,,	95. 1. 1. 18	♀	21·8	12·0	4·0	11·2	7·4	8·6	6·2	13·4	4·0	3·6	,, ,,
,,	95. 1. 1. 19	♀	22·0	12·6	4·0	11·2	8·0	9·0	6·6	13·4	3·8	3·4	,, ,,
France: Trinity, Jersey	8. 9. 2. 10	♂	23·8	14·0	4·2	12·2	8·2	9·6	7·2	14·8	4·0	4·0	,, much worn.
,, ,,	8. 9. 2. 11	♂	24·0	13·4	4·2	12·0	8·4	10·0	7·0	14·4	4·0	3·8	,, ,,
,, ,,		♂	24·2	13·4	4·2	12·2	8·2	10·0	7·2	15·0	4·0	3·8	,, ,,
Bouconne, Gers	153238	♂	23·0	12·8	3·8	11·6	7·8	8·8	7·0	13·2	3·8	3·6	,, moderately worn.
,, ,,	153237	♀	21·0	11·8	3·8	11·2	7·2	8·0	6·2	12·8	3·8	3·6	,, ,,
,, ,,	153241	♀	21·2	11·8	3·8	11·0	7·2	8·2	6·0	13·0	3·8	3·6	,, ,,

France: Solférino, Landes	153256	♂	23·0	12·2	4·0	11·2	7·6	9·2	6·8	14·0	3·8	3·8	Teeth slightly worn.
,, ,,	153257	♀	22·4	12·2	4·0	11·4	7·2	9·0	6·8	13·6	4·0	4·0	,, ,,
Cranves-Sales, Haute-Savoie	5. 4. 4. 2	♂	23·2	13·0	4·0	11·4	7·6	9·4	7·0	14·0	3·8	3·4	,, ,,
,, ,,	5. 4. 4. 3	♂	23·4	12·6	4·0	11·2	7·6	9·2	6·8	14·2	4·0	3·6	,, ,,
,, ,,	5. 11. 18. 11	♂	24·0	13·4	4·2	11·2	8·0	9·6	7·2	14·6	4·0	3·8	,, ,,
,, ,,	5. 11. 18. 12	♂	24·0	13·6	4·4	12·0	8·0	9·2	7·2	15·0	4·0	3·8	,, ,,
,, ,,	5. 11. 18. 13	♂	22·8	—	4·2	11·8	8·0	9·2	6·8	14 6	3·6	3 6	,, ,,
,, ,,	5. 4. 4. 5	♀	22·2	12·8	4·0	11·2	8·0	9·4	6·8	14·0	3·8	3·6	,, ,,
,, ,,	Robert 1913		22·0	13·0	4·0	11·2	7·4	9·2	6·4	13·4	3·6	3·6	,, ,,
Germany: Brunswick	85325	♂	21·8	12·0	3·8	11·6	7·8	8·4	6·4	13·0	3·8	3·8	,, ,,
,,	85332	♂	21·8	12·2	4·0	11·4	7·8	9·0	6·4	13·0	3·6	3·6	,, moderately worn.
,,	85333	♂	22·4	12·2	4·0	11·4	7·8	8·8	6·2	13·4	3·8	3·6	,, slightly worn.
,,	85339	♂	23·4	12·0	4·0	10·8	7·8	9·2	6·8	13·6	4·0	3·8	,, much worn.
,,	85621	♂	23·4	12·0	4·0	11·2	8·0	9·4	6·8	14·0	3·8	3·6	,, ,,
,,	85622	♂	22·8	11·8	3·8	11·0	8·0	8·2	6·2	12·8	3·8	3·8	,, slightly worn.
,,	85623	♂	23·0	12·2	4·0	11·4	7·8	9·2	6·4	13·4	3·8	3·8	,, much worn.
,,	85624	♂	22·8	12·0	4·0	11·2	7·8	9·0	6·8	14·2	3·8	3·6	,, slightly worn.
,,	85346	♀	21·6	12·2	3·8	11·4	7·2	8·6	6·2	13·2	4·0	3·8	,, ,,
,,	85354	♀	22·8	12·4	3·8	11·8	7·6	9·2	6·6	13·8	3·8	3·8	,, moderately worn.
Hausbruch, Hanover	112885	♂	22·2	12·2	4·0	11·2	7·6	8·8	6·4	13·8	3·8	3·6	,, ,,
,, ,,	112888	♂	22·2	12·4	4·0	11·6	8·0	8·8	6·4	14·0	4·0	3·8	,, ,,
Bodethal, Harz Mts.	112901	♂	22·0	11·6	4·0	10·8	7·4	8·4	6·6	13·2	3·6	3·4	,, slightly worn.
Rudolstadt, Thüringen	95. 4. 18. 13	♂	23·2	13·0	4·0	11·8	8·0	9·0	7·0	13·6	3·6	3·4	,, moderately worn.
Niesky, Silesia	99. 1. 9. 18		23·6	13·4	4·0	11·8	7·8	9·4	7·2	15·0	3·8	3·6	,, much worn.
Wolfshau, Riesengebirge, Silesia	112872	♀	22·8	12·6	4·0	11·2	8·0	8·8	6·4	14·0	3·8	3·8	,, ,,
Strass, near Burgheim, Bavaria	1534 9	♂	23·2	12·8	4·2	11·6	7·8	8·8	6·6	13·8	3·8	3·8	,, moderately worn.
,, ,, ,,	153269	♀	24·2	–	4·0	11·6	7·6	9·2	6·8	14·8	4·0	3·8	,, much worn.
Marxheim, Bavaria	153263	♂	22·4	–	3·8	10·8	7·2	9·2	6·8	13·4	3·8	3·6	,, slightly worn.
,, ,,	153264	♂	22·6	–	4·0	11·4	7·2	9·0	6·4	13·2	3·8	3·6	,, moderately worn.

CRANIAL MEASUREMENTS OF *APODEMUS SYLVATICUS*—*continued*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Breadth of brain-case.	Depth of brain-case at middle.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
A. sylvaticus sylvaticus—*contd.*													
Germany: Marxheim, Bavaria	153266	♂	22·8	12·8	4·0	11·6	7·4	9·0	6·8	14·0	3·8	3·8	Teeth moderately worn.
,, ,,	153267	♀	22·6	12·8	4·0	11·8	8·0	9·2	7·0	13·8	3·8	3·6	,, ,,
Strassburg	8. 8. 10. 143	♀	22·4	12·8	4·0	11·8	8·0	9·0	6·4	13·8	3·8	3·8	,, ,,
Austria-Hungary: Hatszeg, Hunyad	3. 2. 2. 25	♂	23·8	13±	4·2	11·8	8·2	9·6	7·4	15·0	4·0	3·8	,, much worn.
,, ,,	3. 2. 2. 30	♀	24·0	13·0	4·2	12·0	8·0	9·8	7·2	14·8	3·8	3·6	,, slightly worn.
,, ,,	3. 2. 2. 32	♀	23·8	13·6	4·0	11·8	—	9·8	7·0	15·0	4·0	3·8	,, moderately worn.
Roumania: Gageni	4. 4. 6. 19	♂	24·0	12·4	4·0	11·8	8·2	9.4	7·2	14·0	3·8	3·4	,, ,,
,,	4. 4. 6. 22	♀	22·4	12·4	4·0	11·6	8·0	8·8	7·4	13·6	4·0	3·6	,, ,,
,,	4. 4. 6. 23	♀	23·0	12·0	4·0	11·6	8·4	9·2	6·6	14·0	3·8	3·6	,, slightly worn.
,,	4. 4. 6. 24	♀	22·6	12·2	4·0	11·2	8·2	8·8	6·6	13·8	3·8	3·6	,, moderately worn.
Switzerland: Geneva	124357	♀	23·2	13·0	4·0	11·2	8·0	9·6	6·8	14·8	4·0	3·6	,, much worn.
,,	124358	♀	23·2	13·2	4·2	11·6	8·0	9·2	6·8	14·4	3·8	3·6	,, ,,
,,	124360	♀	23·8	12·8	4·0	11·6	8·2	9·4	7·4	14·8	3·8	3·6	,, ,,
,,	124364	♀	23·2	12·2	4·2	11·6	8·0	9·2	6·8	14·6	4·0	3·8	,, ,,
Les Plans, Vaud	104508	♀	22·2	12·2	4·0	11·2	8·0	8·8	6·4	13·8	4·0	4·0	,, slightly worn.
Meiringen, Bern	85843	♂	23·6	13·0	4·0	11·8	7·6	9·8	6·4	14·8	4·0	3·8	,, moderately worn.
,, ,,	85868	♀	23·0	12·4	4·0	11·0	8·0	9·6	6·8	14·4	4·0	3·8	,, ,,
,, ,,	85869	♀	23·4	13·0	4·2	11·6	7·8	10·0	6·8	14·4	4·0	4·0	,, ,,
Göschenen, Uri	124563	♂	23·0	12·6	4·0	11·4	7·6	8·8	6·6	14·0	4·0	3·6	,, much worn.
Faido, Ticino	124606	♂	23·8	—	4·2	11·6	8·2	9·8	7·0	14·4	4·0	3·6	,, ,,
,, ,,	124608		24·2	—	4·0	—	—	9·8	7·2	14·6	4·0	3·6	,, ,,

Switzerland: Lugano, Ticino .	111547	♂	24·2	—	4·0	11·8	7·8	10·0	7·0	—	4·0	—	Teeth much worn.
Locarno ,, .	2.7.1.7	♂	24·0	13·8	4·2	12·0	8·0	10·2	7·2	14·8	4·0	3·8	,, ,,
,, ,, .	2.7.1.8	♂	22·8	13·2	4·0	12·0	8·0	9·4	6·4	14·0	4·0	3·8	,, moderately worn.
,, ,, .	2.7.1.9	♂	23·2	13·0	4·0	11·8	8·2	9·2	6·8	14·0	4·0	3·6	,, ,,
,, ,, .	2.7.1.16	♂	24·4	13·4	4·2	11·8	8·2	10·0	7·2	13·8	4·0	3·8	,, much worn.
,, ,, .	2.7.1.10	♀	23·6	13·2	4·2	12·0	8·0	9·6	7·2	14·0	4·0	3·8	,, ,,
,, ,, .	2.7.1.11	♀	22·8	13·0	4·0	12·0	8·0	9·0	6·8	14·0	3·8	3·6	,, ,,
,, ,, .	2.7.1.12	♀	23·2	13·2	4·2	12·0	8·0	9·6	6·8	13·8	4·2	3·8	,, moderately.
Capolago ,, .	2.7.1.6	♀	22·8	12·4	4·0	11·8	8·0	9·0	6·6	13·6	4·0	3·8	,, much worn.
Italy*: Moncalieri, Turin . .	153399	♀	24·0	13·0	4·4	11·6	8·2	9·2	7·0	14·4	4·0	3·8	,, ,,
,, ,, . .	153400	♀	23·6	12·8	4·2	12±	8·0	9·0	6·8	14·8	4·0	3·8	,, moderately worn.
,, ,, . .	Turin 18	♀	22·8	12·2	4·0	11·2	7·6	9·0	7·0	13·8	4·0	3·8	,, ,,
,, ,, . .	,, 21	♀	23·6	—	4·0	11·2	8·0	9·4	6·8	14·6	4·0	3·8	,, ,,
,, ,, . .	,, 15	♂	24·6	—	4·2	11·2	8·0	9·8	7·2	15·0	4·0	3·8	,, ,,
,, ,, . .	,, 20	♂	23·6	—	—	—	—	9·4	7·0	14·4	4·0	3·8	,, much worn.
Ceresole d'Alba, Turin .	153398	♀	22·6	13·0	4·0	11·4	7·4	8·8	6·6	14·0	3·8	3·8	,, moderately worn.
,, ,, ,, .	Turin 16	♀	22·8	12·6	4·0	11·6	7·8	9·0	6·8	14·4	4·0	3·8	,, ,,
,, ,, ,, .	,, 17		23·8	12·6	4·0	11·6	8·0	9·2	6·8	14·2	4·0	3·8	,, much worn.
,, ,, ,, .	,, —	♂	24·0	—	4·0	11·6	7·8	9·4	7·2	14·6	4·0	3·8	,, ,,
A. sylvaticus callipides.													
France: Ax-les-Thermes, Ariège .	172209	♀	23·4	13·0	4·0	11·4	7·8	9·8	6·8	14·6	4·0	4·0	,, slightly worn.
,, ,, ,, .	172206	♂	23·8	13·0	4·2	11·8	8·2	9·6	6·8	14·4	3·8	3·8	,, much worn.
,, ,, ,, .	172208	♂	24·2	12·6	4·2	11·6	7·8	9·6	6·8	14·2	4·0	4·0	,, ,,
,, ,, ,, .	172210	♂	23·6	13·6	4·0	11·4	7·6	10·0	6·6	14·8	4·0	3·8	,, slightly worn.
,, ,, ,, .	172211	♂	23·2	13·0	4·0	11·6	7·8	9·4	6·6	14·4	4·0	3·8	,, moderately worn.
Luchon, Haute-Garonne	153233	♂	23·0	12·4	4·2	11·2	7·8	9·6	6·8	14·0	4·0	4·0	,, slightly worn.
,, ,,	153235	♂	23·0	13·0	4·0	11·8	8·0	9·2	7·0	14·0	3·8	3·8	,, moderately worn.
Barèges, Hautes-Pyrénées	8.8.4.230	♂	23·4	13·0	4·0	11·8	8·2	9·6	6·8	14·2	3·8	4·0	,, slightly worn.
,, ,,	172229	♀	23·6	13·0	4·0	11·6	7·8	9·6	6·6	14·6	4.0	3·8	,, ,,
Spain; Pajáres, Leon . .	8.2.9.110	♂	24·4	13·0	4·2	11·2	8·2	10·0	7·0	14·6	4·0	3·8	,, moderately worn.
,, ,, . .	8.2.9.117	♀	23·8	13·4	4·2	12·0	8·2	9·0	7·0	14·4	3·8	3·6	,, ,,

* The Italian specimens are probably referable to *dichrurus*.

CRANIAL MEASUREMENTS OF *APODEMUS SYLVATICUS*—*continued*.

Locality.	Number.	sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Breadth of braincase.	Depth of braincase at middle.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
A. sylvaticus callipides *contd.*													
Spain: Pajáres, Leon	153168	♂	24·0	13·6	4·2	11·6	8·0	9·8	7·0	14·6	4·2	4·0	Teeth moderately worn.
,, ,,		♀	24·6	13·4	4·0	11·6	7·8	10·4	7·2	14·8	4·2	3·8	,, much worn.
La Coruña, Coruña			22·4	11·8	4·0	11·2	7·8	9·0	6·6	13·8	3·8	3·8	,, moderately worn.
Portugal: Cintra	98. 2. 2. 24	♂	22·6	13·0	4·2	11·8	7·8	9·0	6·6	13·6	4·0	4·0	,, slightly worn.
Estoril	98. 2. 2. 23	♂	23·0	12·8	4·0	11·0	7·6	9·2	6·6	—	4·0	—	,, ,,
,,	98. 2. 2. 26	♂	24·2	13·6	4·2	12·0	7·8	9·8	7·0	14·8	4·0	4·0	,, moderately worn.
A. sylvaticus dichrurus.													
Spain: Jaca, Huesca	8. 2. 9. 126	♂	23·8	13·0	4·0	11·6	7·8	9·4	6·8	14·6	4·2	3·8	,, much worn.
Panticosa, Huesca	8. 2. 9. 118	♂	24·0	13·4	4·2	12·0	8·0	9·6	7·0	15·0	4·2	3·8	,, ,,
,, ,,	8. 2. 9. 119	♂	23·6	13·0	4·2	11·6	8·0	9·8	6·8	14·2	4·0	3·6	,, ,,
,, ,,	8. 2. 9. 121	♂	24·6	13·4	4·2	11·8	8·2	10·2	7·0	15·0	4·0	3·6	,, ,,
Silos, Burgos	172237	♂	24·0	13·2	4·0	12·0	8·0	9·6	7·0	14·8	4·0	4·0	,, slightly worn.
,, ,,	172236	♀	23·8	13·4	4·0	12·0	8·2	10·4	7·2	15·0	4·0	3·6	,, much worn.
,, ,,	8. 8. 4. 68	♂	24·0	13·0	4·0	11·8	8·2	9·4	7·2	14·6	4·0	3·8	,, moderately worn.
Barracas, Castellon	153162	♂	24·0	14·0	4·0	12·2	7·8	10·0	7·2	14·6	4·0	3·8	,, much worn.
Alcoy, Alicante	153157	♂	24·4±	13·8	4·2	11·6	8·0	9·8	7·0	15·0	4·2	4·0	,, moderately worn.
,, ,,	153158	♂	24·6	13·2	4·2	12·0	7·8	10·2	7·2	14·4	4·0	4·0	,, ,,
,, ,,	153153	♀	24·8	13·6	4·0	12·0	8·0	10·0	7·2	15·0	4·0	3·8	,, ,,
Elche ,,	153151	♂	26·0	14·0	4·4	12·6	8·6	10·4	7·8	16·0	4·0	3·8	,, much worn.
,, ,,	153149	♀	24·8	13·6	4·2	12·8	9·0	10·0	7·0	15·6	4·0	4·0	,, ,,

Spain: Venta del Baul, Granada	8. 8. 4. 81	♂	26·0	14·0	4·6	12·0	8·2	10·0	7·2	15·4	4·2	4·0	Teeth moderately worn.
,, ,,	8. 8. 4. 82	♂	24·8	13·0	4·0	12·0	8·4	9·6	6·8	14·6	4·0	3·8	,, slightly worn.
,, ,,	8. 8. 4. 83	♂	25·0	13·0	4·2	11·8	8·0	9·8	7·0	14·8	4·0	3·8	,, ,,
,, ,,	8. 8. 4. 86	♀	24·4	13·2	4·2	12·0	8·0	9·4	7·0	14·4	4·0	3·8	,, moderately worn.
,, ,,	153145	♀	24·6	14·0	4·0	12·6	8·6	9·8	7·0	15·2	4·2	4·0	,, ,,
Guadix ,,	8. 8. 4. 75	♂	26·2	14·0	4·6	12·6	8·2	10·4	7·2	15·0	4·2	4·2	,, much worn.
,, ,,	8. 8. 4. 76	♂	25·2	13·6	4·6	12·2	7·8	10·2	7·0	15·2	4·0	4·0	,, ,,
,, ,,	8. 8. 4. 77	♂	25·0	13·8	4·2	12·2	8·0	10·4	7·2	15·2	4·2	4·0	,, moderately worn.
Inca, Majorca, Balearic Islands	0. 7. 1. 9	♂	25·0	14·0	4·2	12·0	8·0	10·4	7·4	15·2	4·2	4·0	,, ,,
,, ,, ,,	0. 7. 1. 12	♀	23·6	13·0	4·0	11·6	7·6	10·0	6·8	14·6	4·2	3·8	,, ,,
,, ,, ,,	0. 7. 1. 14	♀	23·8	12·6	4·0	11·6	8·0	10·0	7·0	14·6	4·2	4·0	,, ,,
San Cristobal, Minorca	0. 7. 1. 53	♂	25·6	14·0	4·2	12·2	8·6	10 8	7·2	15·0	4·4	4·2	,, ,,
,, ,,	0. 7. 1. 54	♂	24·8	13·6	4·0	12·0	7·6	10·2	7·4	15·0	4·2	4·0	,, much worn.
,, ,,	0. 7. 1. 55	♂	24·2	13·2	4·0	12·0	8·0	10·2	7·2	15·2	4·4	4·0	,, moderately worn.
France; Nimes, Gard	8. 8. 10. 70	♀	24·6	—	4·0	11·4	8·0	10·0	6·8	14·6	4·0	3·8	,, much worn.
,, ,,	8. 8. 10. 72	♀	23·4	13·2	4·2	12·0	7·6	9·6	6·8	14·2	4·0	3·8	,, moderately worn.
St. Paul, Basses Alpes	153206	♀	23·2	12·8	4·2	11·6	8·0	9·6	6·6	14·6	4·0	3·8	,, slightly worn.
Valescure, Var.	8. 8. 4. 190	♂	23·4	12·8	4·2	11·8	8·2	9·4	7·0	14·4	3·8	3·6	,, moderately worn.
,, ,,	8. 8. 4. 192	♂	23·8	13·2	4·0	12·0	8·0	9·2	6·8	14·6	4·2	4·0	,, much worn.
,, ,,	8. 8. 4. 193	♂	23·8	13·2	4·0	11·6	8·0	9·8	7·0	15·0	4·0	4·0	,, moderately worn.
,, ,,	8. 8. 4. 195	♂	25·0	13·4	4·0	11·8	8·0	10·0	7·0	15·0	4·0	3·8	,, much worn.
,, ,,	8. 8. 4. 197	♂	24·6	13 4	4·2	12·0	8·0	9·6	7·2	14·4	4·0	3·8	,, moderately worn.
Agay ,,	8. 8. 4. 198	♂	24·0	13·2	4·2	11·8	8·4	9·8	7·2	14·6	3·8	3·6	,, much worn.
Italy: Genoa	124352	♂	23·2	13·0	4·0	11·6	8·0	9·0	6·8	14·0	4·0	3·8	,, moderately worn.
,,	124355	♂	22·8	12·8	3·8	11·6	7·8	9·4	6·8	13·6	3·8	3·8	,, ,,
,,	124346	♀	24·0	13·4	4·2	11·8	7·4	9·8	6·4	14·0	4·0	4·0	,, much worn.
,,	124349	♀	21·8	12·2	4·0	11·2	7·6	9·0	6·2	13·0	3·8	3·6	,, moderately worn.
,,	124353	♀	22·0	12·2	4·0	11·4	7·8	8·8	6·4	13·6	3·6	3·6	,, ,,
,,	124354	♀	23·2	12·2	4·0	11·4	8·2	9·0	6·6	14·0	3·8	3·8	,, ,,
,,	124356	♀	22·8	12·8	4·0	11·6	8·0	8·8	6·2	14·0	3·8	3·6	,, ,,

CRANIAL MEASUREMENTS OF *APODEMUS SYLVATICUS*—*continued*.

Locality,	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Breadth of brain-case.	Depth of brain-case at middle.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
A. sylvaticus dichrurus—*contd.*													
Italy: Sorrento	103091	♀	23·8	12·8	4·2	11·8	8·0	10·0	7·0	14·0	4·0	3·8	Teeth much worn.
,,	103093	♀	23·6	13·0	4·0	12·0	8·0	9·4	6·8	14·8	4·0	4·0	,, ,,
,,	103094	♀	22·8	12·8	3·8	11·8	8·0	9·6	6·6	14·2	4·0	4·0	,, moderately worn.
,,	103097	♀	23·0	12·8	4·0	11·6	8·0	9·4	6·4	13·8	3·8	3·8	,, ,,
,,	103092	♂	24·8	12·8	4·0	11·8	8·2	9·6	7·0	15·0	4 0	3·8	,, much worn.
,,	103095	♂	22·8	12·8	4·0	11·8	7·8	9·2	6·6	13·8	3·8	3·6	,, moderately worn.
,,	103096	♂	25·0	13·0	4·2	12·2	8·2	10·0	7·0	14·8	4·0	3·8	,, much worn.
Aspromonte	6. 8. 4. 6	♂	25·4	14·0	4·2	12·2	8·6	10 0	7·2	15·6	4·4	4±	,, ,,
,,	6. 8. 4. 7	♂	26·0	14 4	4·4	12·4	8·0	10·4	7·2	16·0	4·6	4·2	,, moderately worn.
Monte Sirino	6. 8. 4. 8	♂	26·0	14·2	4·6	12·2	8·2	10·2	7·4	15·4	4·2	4·0	,, ,,
Sicily: Madonna dell Alto	153345	♂	25·2	13·2	4·2	12·0	8·2	10·0	7·0	15·0	4·0	4·0	,, much worn.
,,	153347	♂	24·8	13·0	4·4	12·4	8·4	9·8	6·6	14·4	4·2	4·0	,, ,,
,,	8. 9. 1. 11	♂	24·4	13·0	4·2	12·0	8·2	9·8	6·8	14·4	4·2	4·0	,, moderately worn.
,,	153344	♂	25·4	14·0	4·2	12·4	—	11·0	7·2	15·6	4·2	4·0	,, ,,
,,	8. 9. 1. 13	♂	25·0	13·4	4·2	12·2	8·0	10·4	7·2	15·0	4·2	4·0	,, much worn.
,,	8. 9. 1. 16	♀	25 0	11·0	4·2	12·2	8·2	10·2	7·0	15·0	4·6	4·0	,, ,,
,,	8. 9. 1. 17	♀	23·6	13·0	4·0	11·8	7·8	9·8	6·8	14·6	4·0	4 0	,, moderately worn.
,,	8. 9. 1. 15	♀	22·4	—	4·2	11·6	8·0	9·8	6·6	14·4	4·2	4·0	,, much worn.
Ficuzza	153339	♀	24·8	13·8	4·0	11·8	8·0	10·0	7·2	15·2	4·0	4·0	,, ,,
,,	153340	♂	24·6	—	4·2	—	—	10·0	7·0	14·6	4·0	4·0	,, ,,
,,	6. 8. 4. 39	♂	25·4	14·0	4·2	12·2	8·0	10·6	7·0	15·2	4·2	4·0	,, slightly worn.
,,	6. 8. 4. 40	♂	25·0	13·2	4·2	12·0	8·0	9·6	7·0	15·0	4·4	4·0	,, ,,

Sicily: San Giuglielmo . .	8. 9. 1. 18	♂	25·4	13·6	4·2	11·6	7·8	10·2	7·2	15·0	4·6	4·0	Teeth much worn.
,, . .	8. 9. 1. 19	♂	25·2	13·2	4·0	11·8	8·0	10·4	7·2	15·2	4·4	4·0	,, ,,
,, .	8. 9. 1. 20	♂	26·2	13·8	4·6	12·6	8·4	11·0	7·4	15·2	4·2	4·0	,, ,,
Castelbuono . . .	153342	♂	24·8	13·8	4·0	12·2	8·2	10·0	7·2	14·4	4·0	3·8	,, ,,
,, . . .	6. 8. 4. 43	♀	23·0	12·8	4·0	11·8	8·2	9·8	6·4	15·0	4·0	3·8	,, ,,
Marsala	6. 8. 4. 35	♂	25·4	13·6	4·0	12·0	8·0	10·2	7·2	15·0	4·2	4·0	,, ,,
Palermo . . .	103294	♂	23·2	12·8	4·2	11·8	8·0	9·4	7·0	14·2	3·8	3·6	,, ,,
,, . . .	103295	♀	24·2	12·8	4·2	11·6	8·0	10·0	7·0	14·4	4·0	4·0	,, moderately worn.
Taormina . . .	122512	♂	26·2	13·8	4·2	12·2	8·6	11·2	7·8	15·8	4·2	4·0	,, much worn.
Greece: Corfu . . .	8. 10. 1. 10	♂	23·0	12·8	4·0	11·6	8·0	9·2	6·8	13·8	4·0	3·8	,, moderately worn.
Cephalonia . .	8. 10. 1. 11	♂	23·6	12·4	4·0	11·8	7·8	9·6	6·8	14·0	4·0	3·8	,, slightly worn.
,, . . .	153316	♂	24·0	13·0	4·0	12·0	8·0	9·8	7·0	14·6	4·2	4·0	,, ,,
,, . . .	153319	♀	24·2	13·2	4·0	11·8	8·0	9·4	7·0	14·6	3·8	3·6	,, much worn.
,, . . .	153320	♀	23·0	13·4	4·0	12·0	8·0	9·2	6·8	14·0	4·0	3·8	,, moderately worn.
Patras	153322	♂	23·2	12·6	4·0	11·4	7·6	9·0	6·8	13·8	3·8	3·8	,, much worn.
near Athens . .	153324	♀	22·8	12·8	4·0	11·6	—	9·0	6·8	13·8	3·8	3·6	,, ,,
,, ,, . . .	153325	♂	23·2	12·8	4·0	11·2	7·8	9·0	6·8	14·0	3·8	3·8	,, slightly worn.
,, ,, . . .	8. 10. 2. 37	♀	22·4	12·4	4·0	11·2	7·6	9·0	6·4	13·8	3·6	3·6	,, ,,
A. sylvaticus creticus.													
Crete: Katharo . . .	5. 12. 2. 25	♂	23·4	13·0	4·2	12·0	8·0	9·4	7·0	14·0	4·0	3·8	,, moderately worn.
,, . . .	5. 12. 2. 26	♂	23·0	12·4	4·2	11·8	7·8	9·0	6·6	13·4	3·8	3·8	,, slightly worn.
,, . . .	5. 12. 2. 27*	♀	22·8	12·4	4·0	11·6	7·6	9·0	6·4	13·8	3·8	3·6	,, much worn.
,, . . .	5. 12. 2. 28	♀	23·2	12·2	4·0	11·6	8·0	9·4	7·0	14·0	4·0	3·6	,, moderately worn.

* Type.

APODEMUS HEBRIDENSIS de Winton.

1895. *Mus hebridensis* de Winton, The Zoologist, 3rd ser., XIX, p. 369, October, 1905. Type in British Museum.

1895. *Mus sylvaticus hebridensis* de Winton, The Zoologist, 3rd ser., XIX, p. 426, November, 1905.

1900. *Mus sylvaticus hebridensis* Barrett-Hamilton, Proc. Zool. Soc., London, p. 403.

1910. *Mus sylvaticus hebridensis* Trouessart, Faune Mamm. d'Europe, p. 151.

Type locality. Uig, Island of Lewis, Outer Hebrides, Scotland.

Geographical distribution. —Island of Lewis, and Barra Island, Hebrides.

Diagnosis.—Size about as in the large southern races of *Apodemus sylvaticus;* head and body, 106 to 112 : tail vertebræ, 95 to 100 ; hind foot about 25 ; condylobasal length of skull, 24 to 25 mm. ; ear reduced in size, barely or not reaching eye when laid forward, its height above meatus 15 to 16 mm., its width in dry specimens noticeably less than in *A. sylvaticus;* general colour of upper parts essentially as in *A. sylvaticus sylvaticus*, but underparts so heavily washed with dull buffy brown that line of demarcation along sides is ill-defined ; pectoral spot present, usually rather longer than in *A. sylvaticus*, but not forming a collar ; skull and teeth as in larger forms of *A. sylvaticus.*

Measurements. - Type (adult male) : head and body, 106 ; tail, 96 ; hind foot, 25 ; ear from meatus, 16. Two adult males and an adult female from the type locality : head and body, 106, 112 and 108 ; tail, 99, 100 and 95 ; hind foot, 25, 25 and 23·5 ; ear from meatus, 16, 16 and 15. For cranial measurements see Table, p. 827.

Specimens examined.—Thirteen, all from the Islands of Lewis and Barra.

Remarks. -While the colour of this animal is occasionally duplicated by specimens from Great Britain and the Continent, the combination of large size, small ear, and dark tints is sufficient to distinguish the Hebridean *Apodemus* as a sharply defined local form.

♂.	Island of Lewis, Hebrides.	W. E. de Winton (C & P).	95. 10. 25. 1. (*Type* of species.)
4 ♂, 5 ♀.	Island of Lewis.	W. E. de Winton (C & P).	8. 10. 11. 13–21.
♂.	Barra Island.	Col. R. W. Pinney (C & P).	11. 1. 3. 314.
♂ al.	Barra Island.	J. McRurie (C & P).	11. 1. 3. 415.

APODEMUS HIRTENSIS Barrett-Hamilton.

1899. *Mus hirtensis* Barrett-Hamilton, Proc. Zool. Soc., London, p. 81. Type in British Museum.
1900. *Mus sylvaticus hirtensis* Barrett-Hamilton, Proc. Zool. Soc., London, p. 404.
1906. *Mus hirtensis* Barrett-Hamilton, Ann. Scottish Nat. Hist., Edinburgh, xv, p. 3, January, 1906.
1910. *Mus sylvaticus hirtensis* Trouessart, Faune Mamm. d'Europe, p. 152.

Type locality.—Island of Saint Kilda, west of Outer Hebrides, Scotland.

Geographical distribution.—Saint Kilda.

Diagnosis.—Similar to *Apodemus hebridensis*, but skull larger (condylobasal length, 25·6 to 26·8) and colour darker.

Measurements.—Type (immature male): head and body, 81; tail, 85; hind foot, 25. Adult male and female from the type locality: head and body, 107 and 110; tail, 91 and 101; hind foot, 24·6 and 24·6; ear from meatus, 17 and 17. For cranial measurements see Table, p. 827.

Specimens examined.—Fifteen, all from Saint Kilda.

Remarks.—Although the material representing the two animals is not entirely satisfactory there seems little reason to doubt that *Apodemus hirtensis* is specifically distinct from *A. hebridensis*. The skull, as shown by the Table of measurements, is distinctly larger, while the colour appears to be somewhat darker than in the Hebridean form, though of exactly the same type. Notwithstanding its large size the skull retains all of the characteristics of that of *A. sylvaticus* and *A. hebridensis*, showing no tendency to assume the angular appearance seen in *A. flavicollis*.

♂.	Island of St. Kilda, Outer Hebrides.	J. S. Elliott (c & p). 94. 7. 16. 1. (*Type* of species.)
♂ and 6 skulls.	St. Kilda. (*H. Evans.*)	G. Barrett-Hamilton 11. 1. 2. 123. (p).
3 ♂, 3 ♀.	St. Kilda.	W. Eagle Clarke 11. 1. 24. 1–6. (c & p).

APODEMUS FRIDARIENSIS Kinnear.

1906. *Mus sylvaticus fridariensis* Kinnear, Ann. Scottish Nat. Hist., xv, p. 48, April, 1906. Type in Royal Scottish Museum.
1910. *Mus sylvaticus fridariensis* Trouessart, Faune Mamm. d'Europe, p. 150.

Type locality.—Fair Isle, Shetland Islands, Scotland.

Geographical distribution.—Fair Isle.

Diagnosis.—Size as in *Apodemus hirtensis* or somewhat larger; skull with rostrum noticeably more slender than in any of the related forms; colour above essentially as in *A. sylvaticus sylvaticus*, but back and sides less bright and more clouded with

black, and underparts entirely dull whitish, the pectoral spot absent or barely indicated.

External characters.—In general external characters *Apodemus fridariensis* agrees with *A. sylvaticus* and *A. flavicollis*, but the ear is relatively not so large, barely covering eye when laid forward, and the palmar and plantar tubercles are relatively smaller. The latter peculiarity is especially noticeable in the hind foot, where the area occupied by the pads as compared with the space between them is distinctly less than in the related species.

Colour.—Upper parts as in the darker less russet specimens of *Apodemus sylvaticus sylvaticus*, the black clouding of median region and "lining" of sides more noticeable than usual in the smaller animal, the "lining" effect on sides increased by a certain harsh loose texture of the fur which causes the dark hair-tips to stand out with unusual distinctness against the light undercolour. Underparts a peculiar dull bluish white, noticeably different from the clear white of *A. flavicollis*, and without trace of the brownish wash so frequently indicated in *A. sylvaticus*, though a faint buffy tinge is sometimes present; pectoral spot usually absent, but occasionally represented by a tuft of brownish hairs. Tail very sharply bicolor, blackish above, whitish below. Feet dull white.

Skull and teeth.—In size the skull of *Apodemus fridariensis* rather exceeds that of the large Mediterranean forms of *A. sylvaticus*, though by no means equalling the maximum of *A. flavicollis*. In general form it is more slender than in the related species, a peculiarity especially noticeable in the rostrum. Brain-case longer and narrower than in *A. sylvaticus*, its upper surface never developing lateral ridges, even in extreme old age. Mandible slender, the coronoid process attenuate, short, noticeably less developed than in the related species. Teeth as in *Apodemus sylvaticus*.

Measurements.—Average and extremes of ten adults: head and body, 108·5 (103–114); tail, 102·4 (97·5–104); hind foot, 24–26·4; ear from meatus, 16·6 (16–18). For cranial measurements see Table opposite.

Specimens examined.—Twenty-three, all from Fair Isle (B.M., U.S.N.M. and Edinburgh).

Remarks.—Notwithstanding its large size this species, like *Apodemus hebridensis* and *A. hirtensis*, appears to be an offshoot of *A. sylvaticus* rather than of *A. flavicollis*. This is indicated chiefly by the slenderness and lack of angularity of the skull, the brain-case, even in excessively old individuals, always retaining the smoothness of surface characteristic of the smaller animal.

♂.	Fair Isle, Shetlands.	N. B. Kinnear (C & P). (*Paratype* of species.)	6. 5. 19. 1.
♂ st.	Fair Isle.	N. B. Kinnear (C & P).	6. 11. 18. 1.
2 ♂, 1 ♀.	Fair Isle.	N. B. Kinnear (C & P).	6. 11. 18. 2–4.
♂, 2 ♀.	Fair Isle.	Duchess of Bedford (C & P).	10. 10. 11. 1–3.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Breadth of brain-case.	Depth of brain-case at middle.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
A. hebridensis.													
Scotland: Uig, Island of Lewis	95. 10. 25. 1*	♂	24·2	13·4	4·2	12·0	8·4	10·0	7·6	15·0	4·0	3·8	Teeth much worn.
,, ,,		♂	24·6	13·8	4·2	12·0	8·6	9·8	7·6	15·4	4·0	3·8	,, ,,
,, ,,		♂	25·0	14·0	4·2	11·8	9·0	10·0	8·0	16·0	4·2	3·8	,, ,,
A. hirtensis.													
Scotland: St. Kilda Island .	94. 7. 16. 1*	♂ juv.	24·0	14·0	4·0	12·2	8·0	10·0	7·2	15·4	4·2	4·0	,, slightly worn.
,, .	11. 1. 2. 123	♂	26·6	14·2	4·0	12·2	8·6	11·6±	8·0	17·0	4·2	4·0	,, much worn.
,, .	153507	♀	26·6	14·6	—	12·4	8·8	10·6	8·0	17·4	4·2	4·0	,, ,,
,, .	1905. 120. 2. 7†	♀	26·0	14·0	4·2	12·4	8·6	—	7·8	16·6	4·2	4·0	,, ,,
,, .	,, 9†	♀	25·6	14·2	4·2	12·6	8·6	—	8·0	17·0	4·0	4·0	,, ,,
,, .	,, 16†	♀	—	—	—	—	—	—	8·0	17·0	4·2	4·0	,, ,,
,, .	,, 17†	♀	26±	14·4	4·2	12·6	—	—	7·8	17·2	4·0	4·0	,, ,,
,, .	1905. 120. 4†	♂	26·8	—	4·2	—	—	11·0	8·2	17·4	4·0	4·0	,, ,,
,, .	1905. 120. 1†	♂	—	—	4·2	—	—	—	8·0	16·8	4·0	4·0	,, ,,
A. fridariensis.													
Scotland: Fair Isle. . .	6. 11. 18. 2	♂	—	—	—	—	—	10·6	8·0	15·6	4·2	4·0	,, ,,
,, . . .	6. 11. 18. 4	♂	25·4	14·0	4·2	12·0	8·4	10·6	7·8	16·0	4·0	3·8	,, ,,
,, . . .	196†	♂	25·6	—	4·0	11·8	8·4	10·8	7·8	15·6	4·4	4·0	,, ,,
,, . . .	289†	♂	25·2	14·0	4·2	11·8	8·2	10·0	7·8	15·6	4·2	4·0	,, moderately worn.
,, . . .	153499	♂	25·2	13·8	4·2	11·8	8·2	10·2	7·4	15·8	4·2	4·0	,, much worn.
,, . . .	153500	♂	25·8	14·2	4·2	12·2	8·0	10·4	7·8	15·8	4·2	4·0	,, ,,
,, . . .	153502	♂	25·4	13·8	4·2	12·2	8·0	10·2	8·0	15·6	4·0	4·0	,, ,,
,, . . .	153503	♂	25·8	—	4·0	12·0	8·0	—	7·8	15·8	4·2	4·0	,, ,,
,, . . .	103504	♀	25·6	14·2	4·2	12·2	8·2	10·4	7·8	15·4	4·2	4·0	,, ,,
,, . . .	103506	♀	25·2	13·6	4·0	12·0	8·0	10·4	7·6	15·6	4·0	4·0	,, ,,

* Type.

† Royal Scottish Museum, Edinburgh.

APODEMUS FLAVICOLLIS Melchior.

(Synonymy under subspecies.)

Geographical distribution.—Central Europe from Sweden and Finland to the Pyrenees, Alps and Greece, and from Great Britain to Roumania and western Russia; eastern limits of range not known.

Diagnosis.—Decidedly larger than *Apodemus sylvaticus sylvaticus*, the only member of the group together with which it occurs; head and body about 100 to 115; tail vertebræ about 105 to 125; hind foot, 23 to 27, most frequently 25; condylobasal length of skull, 25 to 28·8 mm.; skull in old individuals becoming decidedly more angular than that of *A. sylvaticus*; ear large, its height above meatus about 17 to 19 mm.; general colour of upper parts brighter and more russet than in any of the European races of *A. sylvaticus*; underparts always whitish, the line of demarcation along sides sharply defined; chest spot usually larger than in *A. sylvaticus*, frequently spreading laterally to form a complete collar.

External characters.—As in *Apodemus sylvaticus*, except for such slight peculiarities as result from the larger size.

Colour.—Except for the general tendency toward brighter, more russet tints on the upper parts, and the constant absence of all trace of brownish wash below, the colour so exactly resembles that of *Apodemus sylvaticus sylvaticus* as to need no detailed description.

Skull and teeth.—In individuals old enough to show conspicuous wear of the teeth the skull attains a degree of massiveness and angularity never seen in *A. sylvaticus*. This is especially noticeable in the lachrymal and interorbital regions and on the upper surface of the brain-case. The angularity of the interorbital rims in such specimens is continued forward nearly to lachrymal region and is so strongly developed as to produce a slight but evident longitudinal furrow along middle of frontal; posteriorly the rims are continued backward as low but evident ridges extending along sides of brain-case to outer extremities of interparietal. In other respects the skull shows no tangible peculiarities of form as compared with that of the smaller animal. Large specimens of *Apodemus flavicollis* are equal in length to skulls of immature *A. epimelas*; but

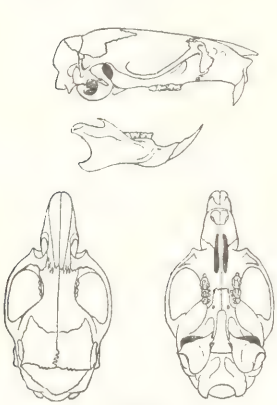


FIG. 167.
Apodemus flavicollis. Nat. size.

the latter may always be distinguished by their larger, smoothly rounded brain-case (a character which persists to extreme old age), relatively deeper rostrum, and larger teeth.

Teeth.—In all respects, except for their slightly larger size, the teeth resemble those of *Apodemus sylvaticus*.

Remarks.—The large general size, long hind foot, and massive, angular skull serve to distinguish adults of this species from individuals of *Apodemus sylvaticus*. Immature specimens are, on the contrary, difficult to determine. The relatively limited distribution of the large animal and the fact that it is not yet known to occur on any of the small islands where *A. sylvaticus* has been found, are both circumstances which suggest the probability that *Apodemus flavicollis* has entered western Europe more recently than the small species. Members of the group occur in the Himalayas; but it is not known how much further east their range extends.

Apodemus flavicollis flavicollis Melchior.

1834. *Mus flavicollis* Melchior, Den Danske Staats og Norges Pattedyr, p. 99 (Sielland, Denmark).

1862. ? [*Mus sylvaticus*] vrt. *major* Radde, Reisen im Süden von Ost-Sibirien, I, p. 180 (Bureja Mountains). Part, specimens mentioned from Crimea which are probably this form.

1866. *Mus cellarius* J. F. Fischer, Zool. Gart., VII, p. 153, April, 1866 (near Luga, St. Petersburg, Russia).

1874. *Mus sylvaticus* Lilljeborg, Sveriges og Norges Ryggradsdjur, I, p. 263 (description based on the large animal).

1894. *Mus flavicollis* de Winton, The Zoologist, 3rd ser., XVIII, p. 441, December 1904 (part).

1900. *Mus sylvaticus typicus* Barrett-Hamilton, Proc. Zool. Soc., London, p. 404. Not *Mus sylvaticus* Linnæus.

1900. *Mus sylvaticus princeps* Barrett-Hamilton, Proc. Zool. Soc., London, p. 408 (Bustenari, in the Carpathians, N.W. of Bucharest, Roumania. Altitude 480 m.). Type in British Museum.

1910. *Mus sylvaticus* and *M. sylvaticus princeps* Trouessart, Faune Mamm. d'Europe, pp. 149, 153.

Type locality.—Sielland, Denmark.

Geographical distribution.—Continental range of the species.

Diagnosis.—White of underparts usually pure and without much suffusion of slaty; chest spot frequently not forming complete collar.

Measurements.—Four adults from Medelpad, Sweden: hind foot, 25, 25, 25 and 26. Adult male and female from Hilleröd, Zealand, Denmark: head and body, 104 and 103; tail, 111 and 104; hind foot, 25 and 24; ear from meatus, 17 and 17·5. Adult male from Nysted, Lolland, Denmark: head and body, 100; tail, 132; hind foot, 27. Average and extremes of five adults from Caterille, Haute-Garonne, France: head and body,

110 (106–114); tail, 106·2 (99–114); hind foot, 24·8 (24–26); ear from meatus, 16·4 (15–18). Adult female from Barèges, Hautes-Pyrénées, France: head and body, 111; tail, 118; hind foot, 24·6; ear from meatus, 19. Average and extremes of six adults from Haute-Savoie, France (Lucinges and Cranves-Sales): head and body, 98·8 (95–103); tail, 100·3 (95–103); hind foot, 25·5 (25–26); ear from meatus, 17·5 (16–20). Two adult females from Brunswick, Germany: head and body, 101 and 97; tail, 116 and 102; hind foot, 24 and 24. Average and extremes of five adults from the Harz Mountains, Germany: head and body, 106·8 (100–110); tail, 110·6 (102–117); hind foot, 25·3 (24·4–26). Adult female from Königsberg, Germany: head and body, 105; tail, 105; hind foot, 26. Adult male from Niesky, Silesia: head and body, 115; tail, 120; hind foot, 24; ear from meatus, 17·5. Adult female from Bustenari, Roumania (type of *princeps*): head and body, 108; tail, 115; hind foot, 25; ear from meatus, 18. Average and extremes of ten adults from Bustenari, Roumania: head and body, 109·3 (101–119); tail, 108·3 (104–115); hind foot, 24·4 (23–25·5); ear from meatus, 18·4 (17·5–20). Average and extremes of six adults from St. Cergues, Vaud, Switzerland: head and body, 108·5 (103–114); tail, 102·3 (98–111); hind foot, 25·9 (25·4–26·4). Average and extremes of four adults from Les Plans, Vaud, Switzerland: head and body, 102·7 (95–120); tail, 119·7 (115–125); hind foot, 25·7 (25–26). Adult male from Murgthal, St. Gallen, Switzerland: head and body, 112; tail, 128; hind foot, 26·4. Two adult males from Faido, Ticino, Switzerland: head and body, 98 and —; tail, 100 and 129; hind foot, 25 and 26. For cranial measurements see Table, p. 832.

Specimens examined.—One hundred and fifty-one, from the following localites:—

Sweden: Jemtland, 2 (U.S.N.M.); Herjedal, 1 (U.S.N.M.); Medelpad, Norrland, 4.

Denmark: Hilleröd, Zealand, 3; Nysted, Lolland, 2 (U.S.N.M.).

France: Ax-les-Thermes, Ariège, 5 (B.M. and U.S.N.M.); Caterille, Haute-Garonne, 6; Barèges, Hautes-Pyrénées, 3; St. Paul, Basses-Alpes, 1; Lucinges, Haute-Savoie, 3; Cranves-Sales, Haute-Savoie, 4; Cenise, Haute-Savoie, 2 (Mottaz).

Germany: Brunswick, 3 (U.S.N.M.); Bahrenberg, Harz Mountains, 3 (U.S.N.M.); Bodethal, Harz Mountains, 6 (U.S.N.M.); Mäusеklippe, Harz Mountains, 5 (U.S.N.M.); Magdeburg, Saxony, 1; Tharandt, Saxony, 1; Strass, near Burgheim, Bavaria, 2; Niesky, Silesia, 1; near Königsberg, 4.

Austria-Hungary: Haida, Arva, Bohemia, 2; Mittelberg, Vorarlberg, 3; Schwaz, Tirol, 2; Hatszeg, Hunyad, 7.

Roumania: Bustenari, Prahova, 15; Gageni, Prahova, 1; Comana, 1.

Albania: Northern Albania, 2.

Switzerland: Geneva, 1 (U.S.N.M.); St. Cergues, Vaud, 7 (U.S.N.M.); Les Plans, Vaud, 3 (U.S.N.M.); Chesières, Vaud, 1 (Mottaz); Meiringen, Bern, 1 (U.S.N.M.); Sitterwald, St. Gallen, 1 (U.S.N.M.); Murgthal, St. Gallen, 3 (U.S.N.M.); Degersheim, St. Gallen, 1 (U.S.N.M.); Wildkirchli, Appenzell, 1; Albula Pass, Grisons, 4 (U.S.N.M.); Julier-Hospiz, Grisons, 1 (U.S.N.M.); Vulpera-Tarasp, Grisons, 4 (Rothschild); Vitznau,

3 (B.M. and U.S.N.M.); Göschenen, Uri, 1 (Mottaz); Faido, Ticino, 4 (U.S.N.M.); Lugano, Ticino, 5 (U.S.N.M.); Locarno, Ticino, 6.
GREECE: Athens, 6; Corfu, 3.

♂, ♀.	Medelpad, Norrland, Sweden.	Lord Lilford (P).	8. 10. 19. 28–29.
3 ♂.	Hilleröd, Zealand, Denmark.	O. Thomas (C & P).	98. 6. 7. 9–10. 13.
2 ♂, ♀.	Ax-les-Thermes, Ariège, France.	V. Builles (C & P).	8. 3. 27. 9–11.
6 ♂.	Caterille, Haute-Garonne. (*A. Robert.*)	O. Thomas (P).	6. 4. 1. 48–53.
♀.	Barèges, Hautes-Pyrénées.	G. S. Miller (C).	8. 8. 4. 221.
3 ♂, ♀.	Cranves-Sales, Haute-Savoie. (*A. Robert.*)	O. Thomas (P).	5. 11. 18. 14–17.
1 al.	Tharandt, Saxony.	Berlin Museum (E.)	93. 1. 1. 19.
1.	Niesky, Silesia. (*W. Baer.*)	Lord Lilford (P).	99. 1. 9. 19.
2 ♂, ♀.	Mittelberg, Vorarlberg, Austria-Hungary. (*Dr. F. Major.*)	O. Thomas (P).	8. 11. 30. 9–11.
5 ♂, 2 ♀.	Hatszeg, Hunyad, Transylvania.	C. G. Danford (C).	{3. 2. 2. 26–29. 31. {3. 11. 8. 32–33.
7 ♂, 8 ♀.	Bustenari, Prahova, Roumania. (*W. Dodson.*)	Lord Lilford (P).	4. 4. 6. 26–40.
	(4. 4. 6. 34. *Type* of *A. princeps* Barrett-Hamilton.)		
♀.	Gageni, Prahova. (*W. Dodson.*)	Lord Lilford (P).	4. 4. 6. 25.
♂, ♀.	North Albania. (*L. Führer.*)	O. Thomas (P).	5. 8. 4. 36.
4 ♂, 2 ♀.	Locarno, Ticino, Switzerland.	O. Thomas (C & P).	2. 7. 1. 13–18.
2 ♂, ♀.	Vitznau, Lucerne.	O. Thomas (C & P).	5. 8. 3. 16–18.
3 ♂, 3 ♀.	Athens. (*C. Mottaz.*)	Hon. N. C. Rothschild (P).	8. 10. 2. 27–32.
♂, 2 ♀.	Corfu. (*C. Mottaz.*)	J. I. S. Whitaker (P).	8. 10. 1. 23–25.

APODEMUS FLAVICOLLIS WINTONI Barrett-Hamilton.

1894. *Mus flavicollis* de Winton, The Zoologist, 3rd ser., XVIII, p. 441, December, 1894 (part).
1900. *Mus sylvaticus wintoni* Barrett-Hamilton, Proc. Zool. Soc., London, p. 406 (part). Type in British Museum.
1910. *Mus sylvaticus wintoni* Trouessart, Faune Mamm. d'Europe, p. 149.

Type locality.—Graftonbury, Herefordshire, England.

Geographical distribution.—Great Britain; not yet recorded from Scotland.

Diagnosis.—White of underparts usually more tinged with slaty than in the Continental form; chest spot usually forming a complete collar and continuing backward along median line nearly to belly.

Measurements.—Type (adult male): head and body, 110; tail, 112; hind foot, 24. Average and extremes of six adults from the type locality: head and body, 108·6 (102–115); tail, 107·5 (92–115); hind foot, 24·1 (23–25); ear from meatus, 17·6 (17–19). Adult male from Woolpit, Suffolk: head and

CRANIAL MEASUREMENTS OF *APODEMUS FLAVICOLLIS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Breadth of brain-case.	Depth of brain-case at middle.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
A. flavicollis flavicollis.													
Sweden: Jemtland	1053 U.S.N.M.		27·2	15·0	4·6	12·6	8·6	11·6	7·8	16·6	4·6	4·2	Teeth moderately worn.
,,	38359	♂	28·4	15·8	4·8	13·2	9·0	11·4	8·2	17·4	4·8	4·4	,, ,,
Herjedalen	38360	♂	28·8	16·0	4·6	12·8	8·2	12·4	8·4	17·4	4·8	4·4	,, ,,
Medelpad	8. 10. 19. 28		25·2	13·4	4·2	12·0	8·4	10·2	7·4	15·8	4·6	4·2	,, slightly worn.
,,	8. 10. 19. 29		26·6	—	4·0	12·2	8·6	11·2	7·8	16·8	4·6	4·2	,, much worn.
,,	153355	♂	26·4	14·4	4·2	12·2	8·4	10·6	7·6	16·2	4·6	4·2	,, moderately worn.
,,	153356	♂	26·6	14·8	4·6	12·4	8·6	10·8	7·6	16·2	4·4	4·0	,, ,,
Denmark: Hilleröd, Zealand	98. 6. 7. 9	♂	26·0	14·0	4·2	12·4	8·2	10·4	7·6	16·0	4·4	4·0	,, much worn.
,, ,,	98. 6. 7. 10	♂	25·0	13·6	4·2	12·2	8·4	10·2	7·2	15·6	4·2	4·0	,, slightly worn.
Nysted, Lolland	141691	♂	27·8	14·8	4·6	12·4	9·0	11·2	8·2	17·0	4·6	4·4	,, much worn.
,, ,,	141692	♀	25·0	13·8	4·2	12·2	8·2	10·0	7·2	16·2	4·2	4·0	,, slightly worn.
France: Caterille, Haute-Garonne	6. 4. 1. 52	♂	27·2	14·4	4·2	11·8	8·8	11·2	8·0	16·4	4·4	4·0	,, moderately worn.
Barèges, Hautes-Pyrénées	8. 8. 4. 221	♀	25·8	14·2	4·0	12·0	8·0	10·4	7·8	16·0	4·2	4·0	,, much worn.
Saint-Paul, Basses-Alpes	153220	♂	25·0	12·2	4·2	12·0	8·2	10·4	8·0	15·0	4·4	4·0	,, slightly worn.
Lueinges, Haute-Savoie	153254	♂	25·8	14·4	4·2	12·2	8·6	10·6	7·4	16·2	4·6	4·2	,, ,,
Cenise ,,	1139 Mottaz	♂	26·2	14·6	4·6	11·8	8·2	11·8	7·8	16·4	4·2	4·2	,, moderately worn.
,,	1187 ,,	♂	25·8	14·2	4·4	12·4	8·2	10·6	8·0	16·2	4·2	4·2	,, ,,
Germany: Brunswick	85324	♂	25·0	12·8	4·0	11·6	8·0	10·0	7·4	15·2	4·0	4·0	,, slightly worn.
Mäuseklippe, Hartz Mts.	112897	♂	25·4	13·0	4·2	12·0	8·2	10·4	7·6	15 0	4·2	4·0	,, ,,

Germany: Bodethal, Harz Mts.	112899	♂	26·0	13·8	4·2	12·2	8·4	10·2	7·6	15·2	4·4	4·0	Teeth slightly worn.
,, ,,	112976	♀	25·6	—	4·2	12·0	8·0	10·0	7·8	15 0	4·2	4·0	,, much worn.
,, ,,	112977	♀	25·8	—	4·2	—	—	10·4	7·8	15·8	4·4	4·2	,, slightly worn.
Tharandt, Saxony.	93. 1. 1. 19	♀	26·0	14·0	4·2	12·2	8·2	10·0	7·4	15·2	4·2	4·0	,, much worn.
Niesky, Silesia	99. 1. 9. 19	♂	26·6	14·2	4·2	12·0	8·0	10·2	8·0	16·0	4·2	4·0	,, slightly worn.
Königsberg	112302	♀	25·2	13·8	4·6	12·2	8·2	10·4	7·2	15·8	4·2	4·0	,, ,,
Strass, near Burgheim, Bavaria		♂	26·4	14·6	4·4	12·2	8·2	11·0	7·8	16·2	4·4	4·0	,, moderately worn.
,, ,,	153270	♂	26·2	14·2	4·2	12·2	8·6	10·2	7·6	16·0	4·2	4·0	,, ,,
Austria-Hungary: Haida, Bohemia		♂	25·0	—	4·2	11·2	8·0	10·0	7·2	15·0	4·4	4·0	,, slightly worn.
,, ,,	153353	♀	25·8	14·0	4·2	11·6	8·0	10·0	7·2	15·6	4·4	4·2	,, much worn.
Mittelberg, Allgäu	8. 11. 30. 9	♂	25·8	13·4	4·2	11·8	8·2	11·4	8·6	15·8	4·4	4·2	,, ,,
,, ,,	8. 11. 30. 11	♀	25·8	13·4	4·2	12·2	8·2	11·8	8·2	16·0	4·2	4·0	,, ,,
Schwaz, Tirol	112836	♂	25·0	13·2	4·0	12·0	8·0	10·4	7·6	15·6	4·2	4·0	,, slightly worn.
Hatszeg, Hunyad	3. 2. 2. 26	♂	25·8	14±	4·6	12·6	8·2	11·0	8·0	15·4	4·6	4·2	,, moderately worn.
,, ,,	3. 2. 2. 29	♂	26·6	14·6	4·4	12·2	8·2	10·6	7·8	16·4	4·8	4·2	,, much worn.
,, ,,	3. 11. 8. 32	♂	25·0	13·4	4·2	12·0	8·0	10·2	7·4	15·2	4·4	4·2	,, slightly worn.
,, ,,	3. 11. 8. 33	♀	26·6	14·0	4·2	12·2	8·0	11·2	7·8	16·0	4·2	4·0	,, moderately worn.
Roumania: Bustenari	4. 4. 6. 28	♂	25·4	13·4	4·2	11·8	8·0	10·2	7·6	15·2	4·2	4·0	,, ,,
,,	4. 4. 6. 29	♂	28·0	14·6	4·6	12·2	8·4	11·2	8·6	17·0	4·2	4·0	,, slightly worn.
,,	4. 4. 6. 30	♂	26·2	14·6	4·4	12·2	8·2	11·0	8·0	15·6	4·2	4·0	,, moderately worn.
,,	4. 4. 6. 32	♂	26·0	14·2	4·2	12·0	7·8	10·8	7·8	16·0	4·2	4·0	,, much worn.
,,	4. 4. 6. 25	♀	25·4	14·0	4·2	12·0	8·2	10·8	7·8	15·6	4·2	4·0	,, ,,
,,	4. 4. 6. 34*	♀	26·2	14·4	4·2	12·4	8·2	10·6	8·0	16·0	4·4	4·2	,, ,,
,,	4. 4. 6. 36	♀	25·8	14·2	4·4	12·4	8·2	10·4	7·6	15·6	4·4	4·0	,, ,,
,,	4. 4. 6. 40	♀	26·4	14·2	4·6	12·2	8·4	10·6	7·6	16±	4·4	4·0	,, ,,
,,	153349	♀	25·4	14·2	4·4	12·6	8·2	10·2	7·6	16·0	4·6	4·4	,, slightly worn.
,,	153350	♂	26·8	14·0	4·4	12·0	8·2	10·6	8·0	15·8	4·2	4·2	,, moderately worn.
,,	153351	♂	26·4	—	4·2	12·6	—	11·0	8·0	15·8	4·4	4·2	,, much worn.
Comana	153348	♀	26·6	14·2	4·4	12·0	8·2	—	8·0	16·4	4·2	4·2	,, ,,

* Type of *princeps* Barrett-Hamilton.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Breadth of brain-case.	Depth of brain-case at middle.	Nasal.	Diastema.	Mandible.	Maxillary toothrow.	Mandibular toothrow.	Observations.
A. flavicollis flavicollis—*contd.*													
Switzerland: Geneva	124362	♂	25·8	14·0	4·2	12·0	7·8	10·2	7·2	16·0	4·6	4·2	Teeth much worn.
Les Plans, Vaud	104501	♂	27·2	14·8	4·4	12·8	8·8	11·0	8·0	16·6	4·4	4·0	,, ,,
,, ,,	104502	♂	26·2	14·2	4·4	12·2	8·4	10·6	7·6	16·2	4·4	4·2	,, moderately worn.
,, ,,	104507	♂	27·2	15·0	4·2	12·2	8·6	11·2	8·2	17·0	4·4	4·2	,, much worn.
Chesières ,,	2746 Mottaz	♀	25·2	14·2	4·2	12·2	8·0	10·2	7·2	16·2	4·6	4·4	,, slightly worn.
Sitterwald, St. Gallen	84719	♂	25·2	13·8	4·2	11·8	8·2	10·0	7·4	15·4	4·2	4·0	,, moderately worn.
Murgthal ,,	123610	♀	25·8	14·2	4·2	12·2	7·8	10·6	7·2	16·0	4·4	4·2	,, ,,
Degersheim ,,	145184	♂	25·8	-	4·4	12·2	8·6	10·4	7·6	15·2	4·0	3·8	,, ,,
Albula Pass, Grisons	84720	♀	25·4	13·8	4·6	12·0	8·0	10·0	7·4	15·2	4·0	4·0	,, slightly worn.
Vulpera-Tarasp ,,	Rothschild Coll.	♂	25·8	14·0	4·4	12·0	8·2	10·2	7·8	15·4	4·2	4·0	,, ,,
,, ,,	,, ,,	♀	26·6	14·0	4·6	12·2	8·0	11·8	8·0	16·2	4·4	4·0	,, much worn.
,, ,,	,, ,,	♀	25·6	13·6	4·0	11·6	8·0	10·6	8·0	15·4	4·2	4·0	,, ,,
,, ,,	,, ,,	♀	25·8	13·8	4·2	12·0	8·2	11·6	8·0	15·8	4·2	4·0	,, moderately worn.
Vitznau	5. 8. 3. 16	♂	27·0	15·0	4·6	12·4	8·6	10·0	8·0	17·0	4·6	4·2	,, ,,
,,	5. 8. 3. 18	♀	26·2	14·8	4·6	12·2	8·8	10·6	8·0	16·8	4·4	4·0	,, much worn.
Göschenen, Uri	1686 Mottaz	♂	25·2	14·0	4·2	12·2	8·2	10·4	7·8	15·8	4·0	4·0	,, moderately worn.
Faido, Ticino	124602	♂	28·4	15·4	4·4	12·8	8·6	12·0	8·0	17·2	4·6	4·4	,, ,,
,, ,,	124604	♂	25·4	—	4·4	—	—	10·4	7·2		4·4	—	,, slightly worn.
,, ,,	124605	♀	26·2	14·8	4·4	12·4	8·6	10·2	7·4	16·4	4·4	4·2	,, moderately worn.
Lugano ,,	124595	♂	26·4	14·2	4·4	12·2	8·6	10·6	7·6	17·0	4·6	4·2	,, ,,
,, ,,	124597	♂	25·2	14·4	4·2	12·0	—	10·2	7·2	16·2	4·6	4·2	,, ,,

Switzerland: Locarno Ticino. .	2. 7. 1. 14	♂	26·0	14·2	4·6	12·2	8·2	10·6	7·8	16·0	4·6	4·2	Teeth moderately worn.
,, ,, . .	2. 7. 1. 15	♂	25·4	14·0	4·2	12·4	9·0	10·2	7·6	16·0	4·2	4·0	,, much worn.
,, ,, . .	2. 7. 1. 8	♀	25·8	14·0	4·2	11·8	8·0	10·4	7·6	15·8	4·4	4·2	,, ,,
,, ,, . .	2. 7. 1. 17	♀	26·8	14·2	4·4	12·0	8·6	11·0	7·8	16·4	4·6	4·2	,, ,,
Albania: northern Albania . .	5. 8. 4. 36	♂	25·8	13·8	4·2	12·0	8·2	10·4	7·6	15·4	4·2	4·0	,, moderately worn.
Greece: Corfu	8. 10. 1. 23	♂	25·6	13·8	4·4	11·8	8·0	10·2	7·8	15·2	4·2	4·2	,, ,,
,, ...	8. 10. 1. 24	♀	27·0	15 0	4·2	12·2	8·0	11·0	8·0	16·2	4·6	4·2	,, much worn.
,, ...	8. 10. 1. 25	♀	—	—	4·4	—	—	10·2	7·6	15·6	4·4	4·4	,, moderately worn.
Tatoi, near Athens . .	8. 10. 1. 30	♀	25·4	13·4	4·2	11·6	7·8	10·0	7·4	15·4	4·2	4·2	,, slightly worn.
,, ,, . .	8. 10. 1. 28	♂	27±	13·4	4·2	11·4	—	10·4	7·8	15·6	4·2	4·0	,, much worn.
,, ,, . .	8. 10. 1. 32	♀	25·2	13·6	4·2	11·8	8·0	10·2	7·4	15·4	4·2	4·0	,, moderately worn.
A. flavicollis wintoni.													
England: Ledbury, Herefordshire.	11. 1. 3. 411	♂	25·6	13·8	4·2	12·2	8·4	9·8	7·6	15·4	4·2	4·0	,, moderately worn.
Bishopstone ,, .	85. 12. 29. 1	♂	26·6	14·8	4·6	13·0	8·8	10·6	7·6	15·8	4·4	4·0	,, ,,
,, ,, .	85. 12. 29. 2	♀	26·0	14·2	4·4	12·2	8·4	10·0	7·6	16·0	4·4	4·0	,, much worn.
,, ,, .	153358	♂	26·8	14·2	4·2	12·2	8·2	10·2	7·8	16·2	4·2	3·8	,, ,,
Graftonbury ,, .	8. 10. 11. 9	♂	26·2	—	4·4	12·0	8·4	10·4	7·6	15·6	4·2	4·0	,, moderately worn.
,, ,, .	8. 10. 11. 7	♀	26·6	14·8	4·2	12·2	8·2	10·0	7·8	16·2	4·2	4·0	,, much worn.
Balcombe, Sussex . .	153557	♀	26·2	—	4·4	12·0	8·2	10·4	7·6	15·8	4·2	4·0	,, moderately worn.
Oundle, Northamptonshire . . .	11. 1. 1. 165	♀	25·4	13·8	4·4	11·8	7·8	10·4	7·2	16·0	4·2	4·0	,, ,,
Woolpit, Suffolk . .	11. 1. 3. 412	♂	26·2	14·2	4·2	12·4	8·2	10·2	7·6	16·4	4·2	4·0	,, slightly worn.

body, 112; tail, 120; hind foot, 24. For cranial measurements see Table, p. 835.

Specimens examined.—Twenty-two, from the following localities in England: Riding, Mill-on-Tyne, Northumberland, 1; Graftonbury, Herefordshire, 13; Ledbury, Hereford, 1; Bishopstone, Hereford, 3; Hereford, no exact locality, 1; Swithland, Leicestershire, 1; Oundle, Northamptonshire, 1; Woolpit, Suffolk, 1; Balcombe, Sussex, 1.

Remarks.—The British race of *Apodemus flavicollis*, though not a well marked form, seems worthy of recognition on account of the duller colour of the underparts and the more diffuse nature of the pectoral spot.

♂.	Riding Mill-on-Tyne, Northumberland, England.	Rev. H. H. Slater (C & P).	11. 1. 3. 413.
♂.	Graftonbury, Herefordshire.	W. E. de Winton (C & P).	0. 3. 12. 1. (*Type* of subspecies.)
4 ♂, 6 ♀, 2 juv.	Graftonbury, Herefordshire.	W. E. de Winton (P).	8. 10. 11. 1–12.
♂, ♀.	Bishopstone, Herefordshire.	H. N. Ridley (P).	85. 12. 29. 1–2.
♂.	Bishopstone, Herefordshire.	Rev. S. O. Ridley (C & P).	81. 1. 1. 4.
♂.	Ledbury, Herefordshire.	Col. J. W. Yerbury (C & P).	11. 1. 3. 411.
♂.	Swithland, Leicestershire.	F. A. Butler (C & P).	11. 1. 3. 410.
♀.	Oundle, Northamptonshire.	Lord Lilford (C & P).	11. 1. 1. 165.
♂.	Woolpit, Suffolk.	W. D. Parker (C & P).	11. 1. 3. 412.

APODEMUS AGRARIUS Pallas.

1778. *Mus agrarius* Pallas, Nov. Sp. Quadr. Glir. Ord., p. 95 (Berlin, Germany).

1801. *M[us] agr[arius] albirostris* Bechstein, Gemeinn. Naturgesch. Deutschlands, I, 2d ed., p. 975 (Thüringen, Germany).

1801. *M[us] agr[arius] maculatus* Bechstein, Gemeinn. Naturgesch. Deutschlands, I, 2d ed., p. 975 (Thüringen, Germany).

1816. *Mus rubens* Oken, Lehrb. d. Naturgesch., III, pt. II, p. 898 (Northern Germany).

1857. *Mus agrarius* Blasius, Säugethiere Deutschlands, p. 324.

1908. *A[podemus] agrarius* Thomas, Proc. Zool. Soc. London, 1908, p. 7, June, 1908.

1910. *Mus* (*Apodemus*) *agrarius* Trouessart, Faune Mamm. d'Europe, p. 155.

Type locality.—Berlin, Germany.

Geographical distribution.—Eastern and central Europe, west along the Baltic coast to Denmark.

Diagnosis.—Size and external appearance about as in *Apodemus sylvaticus*, but colour of upper parts more reddish, and back with a narrow, sharply defined, black median stripe; skull with interorbital region conspicuously beaded, even in half-grown individuals; molars of about the same size as in *A. sylvaticus*,

but m^2 with no minute anterior cusp on outer side, and m_1 and m_2 without cingulum-like outer ledge.

External characters.—The general external form is less slender and delicate than in the members of the *Apodemus sylvaticus* group, the ear is shorter, reaching barely to eye, though not peculiar in structure, the feet are more robust, and the tail is relatively shorter and more coarsely annulated. Palms as in *A. sylvaticus*, except that the two intermediate tubercles are relatively smaller. Feet with metatarsal portion relatively shorter than in *A. sylvaticus*, but toes showing no peculiarities. Plantar tubercles rather small, very sharply defined, the postero-external minute and sometimes obsolete; space between tubercles rugose, though rather less so than in *A. sylvaticus*. Caudal annulations very distinct, about fourteen to the centimeter at middle; caudal hairs essentially as in *A. sylvaticus* but less abundant, the pencil ill-defined. Mammæ: $p\ 2-2$, $i\ 2-2=8$.

Colour.—Upper parts a reddish brown between the russet and wood-brown of Ridgway, brighter posteriorly, more dull anteriorly, fading nearly to ochraceous-buff on sides and cheeks; ears and face between eyes and muzzle noticeably tinged with hair-brown; a clear black median stripe about 3 mm. wide extends from region just behind eyes to within about 10 mm. of base of tail; underparts and inner surface of legs dull white clouded by the slaty undercolour; tail not bicolor, the general effect hair-brown somewhat darker above than below; feet varying from pale drab to dull whitish. The young are essentially like the adults, differing only in a slight general dulness of colour.

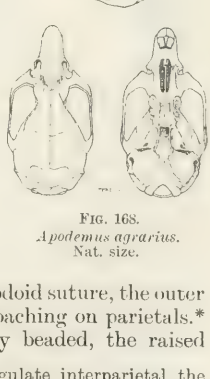


FIG. 168.
Apodemus agrarius.
Nat. size.

Skull.—In general appearance the skull resembles that of *Apodemus sylvaticus*, but the brain-case is longer and narrower and the rostrum is shorter and more noticeably tapering. Profiles essentially as in the related species, but occiput more obliquely truncate, so that a greater portion of the supraoccipital is visible when skull is viewed from above. Interparietal with antero-posterior diameter as in *A. sylvaticus*, but with lateral extremities abruptly and almost squarely truncate at region where bone has width of about 1·5 mm., thus considerably reducing transverse diameter; posterior border of interparietal lying along lambdoid suture, the outer anterior angles of the bone therefore encroaching on parietals.* Margins of interorbital region conspicuously beaded, the raised

* In *Mus musculus*, which has a similarly ligulate interparietal, the lambdoid suture passes along the anterior border of the bone, so that the parietals are not emarginated (fig. 177, p. 866).

edge narrow and abrupt in adults, lower in immature individuals, a faint but evident trace visible in sucklings; posteriorly the head is continued along side of upper surface of brain-case as a slight ridge to lambdal suture, which it meets about 2 mm. beyond termination of interparietal. Anteorbital foramen somewhat more widely open than in *A. sylvaticus*. Incisive foramina noticeably shorter and (relatively) wider than in the other European members of the genus, the posterior margin extending barely or not to level of alveolus of m^1, the anterior margin separated from alveolus of incisor by a distance fully equal to combined width of foramina. Auditory bullæ more inflated than in *Apodemus sylvaticus*, so that hamular is nearly or quite in contact with inflated portion instead of with a contracted beak-like process as in the related species. While in general resembling that of *Apodemus sylvaticus* the mandible is readily distinguishable by the narrower less curved angular process and the higher more curved coronoid, the extremity of which is distinctly above level of condyle.

Teeth.—The teeth are noticeably smaller than in *Apodemus sylvaticus*: alveolar breadth of m^1 scarcely more than one-third greatest width of palate between tooth-rows, the narrowness chiefly due to the relatively small size of the tubercles of the outer row. Crown of m^1 slightly longer than that of m^2 and m^3 together, its area decidedly more than that of the two other teeth combined. Crescents less curved than in *A. sylvaticus*, and showing less tendency to become joined by connecting ridges. First upper molar with *t*3 reduced to a mere appendage to the outer border of *t*2; *t*1 well developed, distinct, very posterior in position, this peculiarity together with the small size of *t*3 producing great distortion of the anterior crescent; no supplemental loops in angles between *t*3 and *t*2 or *t*2 and *t*1. Rest of tooth essentially as in *A. sylvaticus* except for the flattening of the second crescent and the more abrupt rounding of the posterior border resulting from the complete absence of all trace of *t*9. Second upper molar with no trace of *t*3 and with re-entrant angle on outer surface of *t*6 so reduced that the tubercle is often practically entire. Third upper molar as in *A. sylvaticus* but with its elements even more indistinct, and *t*6 practically absent, the outer border of tooth consequently entire. Maxillary teeth essentially as in *A. sylvaticus*, but paired tubercles less distinct from each other and outer ledge with its rudimentary cusps in m_1 and m_2 nearly obsolete.

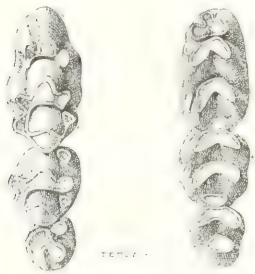


FIG. 109.

Apodemus agrarius. Cheek-teeth. × 10.

CRANIAL MEASUREMENTS OF *APODEMUS AGRARIUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Occipital breadth.	Depth of brain-case at middle.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
Germany: Berlin .	7. 6. 12. 1	♂	24·0	12·0	4·2	10·8	7·2	9·6	7·2	15·0	4·0	4·0	Teeth much worn.
,, .	7. 6. 12. 2	♂	26·0	13·2	4·2	11·4	8·2	10·2	8·0	15·4	3·8	3·6	,, ,,
,, .	7. 6. 12. 3	♂	23·6	12·4	4·2	10·8	8·0	9·8	7·0	14·4	3·8	3·6	,, ,,
,, .	7. 6. 12. 5	♀	24·6	13·0	4·2	11·0	7·6	9·8	7·2	14·6	4·0	3·6	,, ,,
,, .	7. 6. 12. 7	♀	23·6	12·8	4·0	10·8	7·2	9·4	7·0	14·0	3·6	3·8	,, ,,
,, .	7. 6. 12. 8	♀	23·6	12·0	4·0	11·0	7·4	9·4	7·0	14·4	3·8	3·8	,, ,,
Magdeburg	92. 12. 1. 14	♀	23·8	12·8	4·0	10·8	7·8	9·2	7·0	14·2	3·6	3·8	,, ,,
Königsberg	112318	♂	24·2	—	4·0	—	7·6	10·0	7·2	14·2	3·8	3·8	,, ,,
,,	112319	♀	23·0	11·8	3·8	10·4	7·4	9·8	6·8	13·4	3·8	3·6	,, moderately worn.
Roumania: Bustenari .	4. 4. 6. 50	♂	–	12·4	4·2	11·0	7·2	9·4	7·0	13·8	4·0	3·8	,, much worn.
,, .	4. 4. 6. 52	♀	22·6	12·0	4·0	10·4	7·4	9·0	6·6	13 4	4·0	3·8	,, moderately worn.

Measurements.—Average and extremes of eight adults from Berlin, Germany: head and body, 98·1 (97–112); tail, 78·5 (73–84); hind foot, 19·2 (18–21); ear from meatus, 11·2 (11–12). Average and extremes of five adults from the vicinity of Königsberg, Germany: head and body, 107·8 (99–115); tail, 76·4 (71–84); hind foot, 19·1 (18·6–19·8). Adult male from Bustenari, Roumania: head and body, 102; tail, 82; hind foot, 18·5. For cranial measurements see Table, p. 839.

Specimens examined.—Sixty, from the following localities:—
GERMANY: Berlin, 9 (B.M. and U.S.N.M.); Herrenkrug, Magdeburg, Saxony, 8; Altenburg, 1; Zöschau, Saxony, 1 (U.S.N.M.); Tausha, Saxony, 1 (U.S.N.M.); Bieberstein, Saxony, 1; Saxony, no exact locality, 2 (U.S.N.M.); vicinity of Königsberg, 32 (U.S.N.M.).
AUSTRIA-HUNGARY: Eszek, Slavonia, 1.
ROUMANIA: Bustenari, 1; Gageni, 2.
BULGARIA: Rustschuk, 2 (Andersen).

Remarks.—This animal is immediately recognizable among European *Muridæ* by the sharply defined black dorsal line, and among the smaller members of the family by the noticeably beaded margin to the interorbital portion of the skull. A similar colour pattern occurs in the structurally very different *Sicista trizona*, and as the ranges of the two animals partly coincide confusion may easily result. Superficially *Sicista trizona* is perhaps most readily distinguished from *Apodemus agrarius* by the presence of the large, tufted lobe at base of inner portion of ear capable of completely closing the meatus.

3 ♂, 5 ♀.	Berlin, Germany.	Dr. L. Heck (C & P).	7. 6. 12. 1–8.
4 ♂. 1 ♀ al.	Herrenkrug, Magdeburg, Saxony.	Dr. W. Wolterstorff (C & P).	92. 12. 1. 10–17.
♀	Altenberg, Saxony. (*Moschler.*)	E. R. Alston (P).	79. 9. 25. 42.
1 al.	Bieberstein, Saxony. (*Nitsche.*)	Berlin Museum (E).	93. 1. 1. 18.
1 al.	Eszek, Slavonia, Hungary.	Budapest Museum (E).	94. 7. 23. 1.
♂	Bustenari, Prahova, Roumania. (*W. Dodson.*)	Lord Lilford (P).	4. 4. 6. 50.
♂, ♀.	Gageni, Prahova, Roumania. (*W. Dodson.*)	Lord Lilford (P).	4. 4. 6. 51-52.
♀		Purchased (Vereaux).	63. 11. 16. 3.

GENUS MICROMYS Dehne.

1841. *Micromys* Dehne, Micromys agilis, ein neues Saugthier der Fauna von Dresden, p. 1.
1857. *Mus* Blasius, Säugethiere Deutschlands, p. 309 (part).
1905. *Micromys* Thomas, Ann. and Mag. Nat. Hist., 7th ser., XV, p. 442, May, 1905 (part).

Type species.—*Micromys agilis* Dehne = *Mus soricinus* Hermann.

Geographical distribution. Central Europe and Asia from

Great Britain eastward; in Europe north to Scotland and Denmark, south to Italy and southern France.

Diagnosis.—Skull differing from that of *Apodemus* in the greatly reduced rostrum (distance from gnathion to lower edge of infraorbital foramen less than depth through lachrymal region) and in the early fusion of nasal bones along median line; teeth essentially as in *Apodemus*, but m^1 with third outer tubercle obsolete; ear with large triangular valve capable of completely closing the meatus; tail prehensile, bare above at tip; two posterior palmar tubercles united in median line.

Remarks.—This genus is well defined by the peculiarities of the skull, ear, tail and palm. At present one species only is known, the widely distributed harvest mouse.

MICROMYS MINUTUS Pallas.*

(Synonymy under subspecies.)

Geographical distribution. — Same as that of the genus *Micromys*.

Diagnosis.—General characters as in the genus; size very small (head and body, 55 to 75 mm.; hind foot, 13 to 16 mm.; condylobasal length of skull, 16 to 18 mm.); colour above brown with a yellowish or russet tinge, below whitish or buffy.

External characters.—General form slender and delicate, but head rather short and round, owing to the reduced condition of the rostrum. Ear low and rounded, extending barely half way to eye when laid forward, its height above crown only about 5 mm.; lower portion of conch with conspicuous triangular lobe 2 mm. in height capable of completely closing the meatus; surface of ear finely pubescent both inside and out, the meatal valve with a conspicuous tuft of hairs nearly 5 mm. in length. Feet relatively broader than those of *Apodemus sylvaticus*, but proportions of digits not peculiar; palmar and plantar tubercles essentially as in *Apodemus sylvaticus*, but posterior plantar tubercles relatively larger and more elongate, and posterior palmar tubercles so enlarged that they are confluent along median line behind, forming with the thumb a single tubercular mass opposed to the balls of the fingers. Tail prehensile, about as long as head and body, thinly haired below, more thinly above, the distal fifth or sixth of upper surface bare; no true pencil, but an inconspicuous tuft usually projects beyond under side of naked tip; annulations everywhere more distinct and regular below than above, this especially true of prehensile terminal area where the rings are completely broken up on dorsal surface; at middle there are about sixteen to the centimeter.

Colour.—See descriptions of subspecies.

* 1771. *Mus minutus* Pallas, Reise durch verschiedene Provinzen des Russischen Reichs, I, p. 454 (Banks of the Volga, Russia).

Skull.—The skull differs conspicuously from that of all other European *Murinæ* in the striking contrast between the short weak rostrum and the large, much elongated brain-case; distance from upper border of infraorbital foramen to tip of nasal less than one-third that from foramen to posterior border of occiput, while in other members of the sub-family it is nearly one half. Dorsal profile gradually rising and nearly straight from tip of nasals to interorbital region (sometimes with a faint angle at middle of nasals), then broadly convex, slightly more gradually anteriorly than posteriorly, to interparietal, where a slight break in the profile is produced by the more abrupt convexity of the overhanging posterior portion of brain-case; ventral profile without special features, essentially straight from incisor to condyle, except for the slight break caused by the auditory bullæ. Brain-case oval in outline when viewed from above, a little flattened posteriorly, the surface very smooth and evenly inflated; posterior portion unusually distinct from main part of brain-case, and almost marked off by a constriction at front of interparietal; in posterior view the middle portion of brain-case rises unusually high above interparietal, and distance from lambdoid suture to upper margin of foramen magnum is unusually reduced; paroccipital processes very short, extending scarcely to level of lower lip of foramen; floor of brain-case with no special features, the median ridge and lateral furrows well developed, the anterior width of basioccipital less than median length; auditory bullæ rather large, evenly inflated, without evident beak, the meatus relatively large, without lip except along anterior border. Interorbital region rather wide and short, smoothly rounded off at sides though tending to become slightly angular posteriorly in old individuals. Zygoma slender and weak, the arch without special features, the horizontal plate forming outer wall of anteorbital foramen rather narrow, producing a very inconspicuous forward projection on anterior border of zygomatic root when viewed from above, its own anterior border faintly concave and sloping obliquely forward from above downward. Nasals not peculiar in general form, their posterior border together with that of nasal branches of premaxillaries deeply and irregularly lacinate,* not extending noticeably behind lachrymal level. Incisive foramina relatively larger than in *Apodemus sylvaticus*, their outer border nearly parallel, the posterior border extending to level of anterior root of m^1, the anterior border separated from incisor by space equal to greatest width of single foramen. Anterior portion of palate

FIG. 170.
Micromys minutus.
Nat. size.

* Not successfully represented in fig. 170.

without special peculiarities; a slightly indicated transverse ridge at level of posterior border of last molar; mesopterygoid space beginning about 1 mm. behind this ridge, much narrower anteriorly than posteriorly, its margins straight to tip of hamular, which is barely or not in contact with auditory bulla. Mandible essentially like that of *Apodemus sylvaticus*, but with barely indicated swelling over root of incisor, more concave upper margin of angular process, and coronoid more abruptly hooked backward.

Teeth.—General character of teeth much as in *Apodemus sylvaticus*, but upper incisor perhaps a little more compressed and root of lower incisor scarcely forming an appreciable protuberance on outer side of mandible. Relative size of upper molars more nearly as in *Apodemus sylvaticus* than as in *A. agrarius*, but outline of m^1 intermediate between that in these two species. Inner and outer tubercles about equal in size. First upper molar with anterior crescent somewhat distorted, *t*3 well developed though closely crowded against *t*2, *t*1 somewhat posterior in position, the three tubercles less contrasted in size than in the species of *Apodemus;* no intermediate folds in narrow angles between bases of tubercles, but a rather well defined ridge from *t*1 to inner base of *t*5; *t*6 very large, filling nearly the entire space occupied by it and *t*9 in *Apodemus sylvaticus;* *t*9 reduced to a mere rudiment at posterior base of *t*6; postero external margin of crown with slight thickening of the enamel as in *Apodemus sylvaticus;* *t*8 and *t*7 showing no special peculiarities. Second upper molar with first crescent represented by a minute though evident *t*3 and a small *t*1; second crescent with simple *t*6 about equal in size to *t*4; third crescent with barely indicated *t*9 and small *t*7. Third upper molar much as in *Apodemus sylvaticus*, its crown showing traces of tubercles 1, 4, 5, 7 and 8. Maxillary molars as in *Apodemus sylvaticus*, but outer ledge of m_1 and m_2 slightly developed and without evident cusps.

FIG. 171.
Micromys minutus.
Cheek-teeth. × 10.

Remarks.—Two well marked races are recognizable among the harvest mice of western Europe. True *Micromys minutus* is apparently not found in this region.

KEY TO THE EUROPEAN FORMS OF *MICROMYS MINUTUS.*

Head and shoulders reddish brown, essentially concolor with back (England and western continental Europe)..... *M. minutus soricinus*, p. 844.

Head and shoulders greyish, noticeably contrasted with reddish brown back (Hungary and Roumania)..... *M. m. pratensis*, p. 846.

Micromys minutus soricinus Hermann.

1780. *Mus soricinus* Hermann in Schreber, Säugethiere, IV, p. 661, pl. CLXXXIII B. (Strassburg, Germany).

1785. [*Mus*] *triticeus* Boddaert, Elenchus Anim., I, p. 111 (Hampshire, England).

1789. *Mus minimus* White, Nat. Hist. and Antiqu. of Selborne, p. 43; described, pp. 33, 34 and 39 (Selborne, Hampshire, England).

1792. *Mus messorius* Kerr, Anim. Kingd., p. 230 (Hampshire, England).

1794. "*Mus avenarius* Wolf, Versuche die Feldmäuse zu vertilgen, p. 16, 315," Hermann, Observ. Zool., p. 61, 1804 (Locality not mentioned).

1801. *Mus pendulinus* Hermann, Observ. Zool., p. 61 (Strassburg, Germany).

1804. *Mus parvulus* Hermann, Observ. Zool., p. 61 (Strassburg, Germany).

1816. ? *Mus arvensis* Leach, Syst. Catal. Spec. Indig. Mamm. and Birds, Brit. Mus., p. 7 (Nomen nudum: "Harvest Rat").

1822. *Mus campestris* Desmarest, Mammalogie, pt. 2, p. 543 (France).

1832. *Mus meridionalis* Costa, Fauna del Regno di Napoli, p. 13 (Vicinity of Naples, Italy).

1840. *Mus minatus* Schinz, Europ. Fauna, I, p. 70.

1841. *Micromys agilis* Dehne, Micromys agilis, ein neues Säugthier der Fauna von Dresden, p. 1 (Dresden, Germany).

1841. *Mus oryzivorus* de Sélys-Longchamps, Atti della seconda Riunione degli Scienziati Italiani, Torino, 1840, p. 247 (Rice fields of Lombardy, Italy).

1842. *Mus pumilus* F. Cuvier, Hist. Nat. des Mammif., Tabl. gén. et Méth., p. 4. Described in fasc. XXXII, October, 1821 (Vicinity of Paris, France).

1857. *Mus minutus* Blasius, Säugethiere Deutschlands, p. 326.

1900. *Mus minutus agilis* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., V, p. 529, June, 1900 (Brunswick, Germany).

1900. *Mus minutus campestris* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., V, p. 529, June, 1900 (Waremme, Liége, Belgium).

1900. *Mus minutus minimus* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., V, p. 530, June, 1900 (England).

1910. *Mus* (*Apodemus*) *minutus agilis*, *M.* (*A.*) *minutus campestris*, *M.* (*A.*) *minutus minimus* and *M.* (*A.*) *meridionalis* Trouessart, Faune Mamm. d'Europe, pp. 156, 157.

Type locality.—Strassburg, Germany.

Geographical distribution.—Central Europe from Great Britain to eastern Germany, and from Scotland (Aberdeenshire) and Denmark south to Italy and southern France.

Diagnosis.—Colour of upper parts essentially uniform throughout, the shoulders, neck and head never conspicuously greyish.

Colour.—Winter pelage (England and Switzerland): upper parts a nearly uniform reddish brown approaching the tawny of Ridgway but more vivid, especially along median region: neck and head sometimes not so bright as back, but never sufficiently so to produce any marked contrast; sides of body and outer surface of legs fading toward ochraceous-buff; back very inconspicuously sprinkled with black-tipped hairs; ear concolor

with sides; underparts and inner surface of legs dull white to base of hairs, or with a slaty under-tint, the line of demarcation along sides sharply defined; feet, a light, indefinite yellowish brown; tail obscurely bicolor, the hairs everywhere ochraceous-buff, the skin light brown below, dark above. Summer pelage (Germany): upper parts noticeably darker and duller than in winter, approaching the russet of Ridgway, but with a tinge of rufous; sides dull cinnamon; underparts dull ochraceous-buff, the line of demarcation along sides inconspicuous, the median line, especially of chin and throat, often with traces of white in the form of ill-defined lines and blotches; feet and tail as in winter, but more thinly haired and therefore more obscurely coloured.

Measurements.—Two adult males from Norfolk, England: head and body, 64 and 65; tail, 61 and 58; hind foot, 15 and 14; ear from meatus, 9 and 8. Adult male and female from Waremme, Belgium: head and body, 68 and 70; tail, 60 and 65; hind foot, 14 and 16. Average and extremes of ten adults from Brunswick, Germany: head and body, 68·3 (63–76); tail, 59·7 (51–70); hind foot, 14·9 (14–16). Adult male from Pavia, Italy; head and body, 63; tail, 72; hind foot, 15·4; ear from meatus, 10. For cranial measurements see Table, p. 847.

Specimens examined.—Eighty-seven, from the following localities:—

England: Haddiscoe, Norfolk, 11; Swaffham, Norfolk, 2; Methwold Fen, near Brandon, Norfolk, 1; Congham, Norfolk, 1; eastern Norfolk, 3; Norfolk (no exact locality), 3; Cambridgeshire, 1; Colchester, Essex, 6; Kingsbury, Middlesex, 1; Somersetshire, 1; Totton, New Forest, 1; Hampshire, 1; no exact loeality, 2.

France: Étupes, Doubs, 5 (Mottaz); Rugles, near Évreux, Eure, 2 (U.S.N.M.).

Belgium: Waremme, Liége, 3 (U.S.N.M.).

Germany: Holstein, 1; Brunswick, 27 (U.S.N.M.); near Königsberg, 9 (U.S.N.M.); Strassburg, 1.

Switzerland: St. Fiden, St. Gallen, 1 (U.S.N.M.).

Italy: Pavia, 4 (Ghidini).

Remarks.—For the present it seems necessary to regard all the harvest mice of western Europe, including England and northern Italy, as belonging to a single race. The differences which have been observed to exist, notably between British and German specimens, prove to be merely seasonal.

4 ♂, ♀	Haddiscoe, Norfolk, England. (*L. C. Forman.*)	G. Barrett-Hamilton (P).	11. 1. 2. 124–128.
1.	Congham, Norfolk.	Oxley Grabham (C & P).	11. 1. 3. 414.
3 ♂.	Norfolk. (*Oxley Grabham.*)	G. Barrett-Hamilton (P).	11. 1. 2. 129–131.
1	Cambridgeshire.	J. Baker (C & P).	39. 9. 29. 31.
4 ♂, 2 ♀.	Colchester, Essex.	Dr. Henry Laver (C & P).	3. 4. 8. 1–6.
1.	Kingsbury, Middlesex. (*J. L. Harting.*)	E. R. Alston (P).	79. 9. 25. 61.
1 al.	Totton, Hampshire.	E. B. Wharton (C & P).	83. 4. 30. 1.

1.	Somerset. (*Hügel.*)	E. R. Alston (P).	79. 9. 25. 62.
1.	Holstein, Germany.	Purchased (Brandt).	47. 4. 5. 2.
1.	Strassburg, Alsace.	C. Mottaz (C).	8. 8. 10. 90.

Micromys minutus pratensis Ockskay.

1831. *Mus pratensis* Ockskay, Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur., xv, pt. II, p. 243, pl. LXVIII (Western Hungary).
1882. *Mus arundinaceus* Petényi, Termeszetrajzi Füzetek, v, p. 142.
1900. *Mus minutus pratensis* Barrett-Hamilton, Ann. and Mag. Nat. Hist., 7th ser., v, p. 530, June, 1900.
1910. *Mus* (*Apodemus*) *minutus pratensis* Trouessart, Faune Mamm. d'Europe, p. 157.

Type locality.—Western Hungary.*

Geographical distribution.—Hungary and Roumania; limits of range not known.

Diagnosis.—Similar to *Micromys minutus soricinus*, but head and anterior half of body decidedly greyish.

Colour.—Posterior half of back together with outer surface of hind legs as in *M. soricinus*. Head and anterior half of body a buffy grey, darker and more brownish along median dorsal region, lighter and more nearly smoke-grey on sides of neck and shoulders, deepening gradually to a buffy ochraceous posteriorly. Underparts and inner surface of legs sharply defined creamy white, to which the slaty basal portion of the hairs imparts a bluish tinge. Feet a dull indefinite buffy brown. Tail rather sharply bicolor, dark brown above, pale buffy below.

Measurements.—Adult female from Gageni, Roumania: head and body, 63; tail, 55; hind foot, 14·5; ear from meatus, 9. Four adults from Csallóköz-Somorja, Pressburg, Hungary: hind foot, 13·2, 13·6, 14 and 14.

Specimens examined.—Nine, from the following localities:—
Austria-Hungary: Csallóköz-Somorja, Pressburg, Hungary, 6; Cepin, near Eszek, Slavonia, 2 (in spirit).
Roumania: Gageni, Prahova, 1.

Remarks.—The few specimens examined indicate that this is a well-defined race.

6.	Csallóköz-Somorja, Pressburg, Hungary.	Budapest Museum (E).	94. 3. 1. 53-58.
2 al.	Cepin, Slavonia.	Budapest Museum (E).	94. 7. 23. 11-12.
♀	Gageni, Prahova, Roumania. (*W. Dodson.*)	Lord Lilford (P).	4. 4. 6. 49.

* "Frequentius occurrit in Comitatus Nittrienses, valle Vagi."

CRANIAL MEASUREMENTS OF *MICROMYS MINUTUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Breadth of brain-case.	Depth of brain-case at middle.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
M. minutus soricinus.													
England: Colchester . .	3. 4. 8. 1	♂	16·2	9·2	3·0	8·8	5·6	5·4	4·0	9·2	2·8	2·6	Teeth slightly worn.
,, . .	3. 4. 8. 2	♂	16·2	9·2	3·0	8·8	5·8	5·6	4·2	9·0	2·8	2·8	,, ,,
,, . .	3. 4. 8. 3	♂	16·0	9·0	3·0	8·8	5·6	5·6	4·2	9·2	2·8	2·6	,, ,,
,, . .	3. 4. 8. 4	♂	16·0	9·0	3·2	8·8	5·6	5·8	4·0	9·0	2·6	2·6	,, ,,
,, . .	3. 4. 8. 6	♀	16·0	9·0	3·2	8·8	5·6	5·4	4·0	9·2	2·6	2·6	,, ,,
Eastern Norfolk .	86920	♂	16·2	9·2	3·0	8·6	5·2	5·4	4·2	9·2	2·8	2·6	,, moderately worn.
France: Rugles, Eure . .	153435	♂	17·0	9·2	3·0	8·8	5·6	5·8	4·2	9·2	2·8	2·6	,, slightly worn.
,, ,, . .	153434	♀	16·4	9·0	3·0	8·8	5·6	5·4	4·0	9·0	2·8	2·6	,, ,,
Belgium: Waremme, Liége .	85999	♂	—	9·0	3·2	8·8	—	6·0	4·0	9·4	3·0	2·6	,, ,,
,, ,, .	86000	♀	16·8	9·0	3·0	8·8	5·6	5·6	4·2	9·2	3·0	2·6	,, ,,
Germany: Brunswick . .	85365	♂	17·6	9·0	3·0	9·0	6·2	6·0	4·4	10·0	2·8	2·6	,, ,,
,, . .	85366	♂	16·4	9·0	3·0	8·8	5·8	6·0	4·0	9·2	2·8	2·6	,, ,,
,, . .	85629	♂	16·8	9·2	3·2	9·0	6·0	5·8	4·2	9·4	2·8	2·6	,, ,,
,, . .	85634	♂	17·4	9·6	3·2	9·6	6·0	—	4·4	9·8	3 0	2·6	,, much worn.
,, . .	85357	♀	17·8	9·6	3·2	9·2	5 6	6·0	4·6	10·0	3·0	2·6	,, moderately worn.
,, . .	85370	♀	17·0	9·2	3·0	9·0	5·6	5·6	4·2	9·2	2·8	2·6	,, slightly worn.
,, . .	85628	♀	17·6	9·2	3·0	9·0	6·0	6·0	4·6	9·8	2·8	2·6	,, ,,

Genus **EPIMYS** Trouessart.

1857. *Mus* Blasius, Säugethiere Deutschlands, p. 309 (part).
1867. *Rattus* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LVI, p. 63 (not of Donovan, 1827).
1881. *Epimys* Trouessart, Bull. Soc. d'Études Sci. d'Angers, x. p. 117 (sub-genus). Type by subsequent selection *Mus rattus* Linnæus.
1910. *Epimys* Miller, Proc. Biol. Soc. Washington, XXIII, p. 58, April 19, 1910.

Type species.—*Mus rattus* Linnæus.

Geographical distribution.—Originally confined to the temperate and tropical portions of the Old World, but now essentially cosmopolitan through the artificial dispersal of two species.

Characters.—External form, skull, and teeth with no special modifications: molars slightly graduated in size from first to third, the anterior tooth not tending to assume the main function of the tooth-row, the posterior tooth not tending to disappear; enamel foldings of upper molars directly referable to a simple 9-cusped pattern and its reductions, the outer margin of m^1 and m^2 never with more than three cusps, the inner margin of the same teeth never with more than two cusps; m^1 with five roots, its first lamina not distorted by the backward displacement of $t1$; upper incisor compressed, set at such an angle that its outer side is worn smoothly away by action of lower teeth.

Remarks. The genus *Epimys* is the most widely distributed and abundantly represented group in the subfamily *Murinæ*. As here defined it contains the great mass of the Asiatic, Malayan and African species, several hundred in number, to which the generic name *Mus* has during recent years gradually become restricted. Only two of these occur in Europe.

KEY TO THE EUROPEAN FORMS OF *EPIMYS*.

Greatest breadth of brain-case across lateral ridges about equal to length of parietal measured along ridge; first lamina of m^1 and terminal heel of m^2 with no well developed outer tubercle; external form rather heavy; tail decidedly shorter than head and body (Norway rat) ..... *E. norvegicus*, p. 858.

Greatest breadth of brain-case across lateral ridges decidedly more than length of parietal measured along ridge; first lamina of m^1 with distinct outer tubercle usually almost as large as inner tubercle; terminal heel of m^2 with evident though incompletely separated outer tubercle; external form slender; tail about equal to head and body (usually a little longer) *E. rattus*, p. 849.

General colour slaty black, the underparts dark slaty grey (Distribution general) ..... *E. r. rattus*, p. 853.

General colour brown, the underparts buffy or greyish (Southern) ..... *E. r. alexandrinus*, p. 854.

EPIMYS RATTUS Linnæus.

(Synonymy under subspecies.)

Geographical distribution.—Originally confined to the north temperate portions of the Old World; now essentially cosmopolitan through artificial dispersal.

Diagnosis.—Skull with brain-case broad, its greatest breadth across lateral ridges decidedly more than length of parietal measured along ridge; anterior upper molar without trace of cingulum at anterior border of crown; first lamina of m^1 with distinct outer tubercle usually almost as large as inner tubercle; terminal heel of m^2 with evident though incompletely separated outer tubercle; first and second lower molars usually with evident small supplemental tubercles at outer extremity of furrows; form slender; tail about as long as head and body (usually somewhat longer); ear when laid forward extending about to middle of eye; hind foot of adults usually under 40 mm. in length; condylobasal length of adult skulls usually 38 to 43 mm.

External characters.—General form rather slender, the tail usually longer than head and body and never, unless injured, noticeably shorter. Head slender, tapering anteriorly, the ear rather large, extending about to middle of eye when laid forward, its substance thin and somewhat translucent, its general outline broadly oval, the basal portion of anterior border folded backward (inward); posterior border of meatus with barely indicated ridge; surface of ear finely papillose and very inconspicuously pubescent. Muzzle pad small but well defined, with deep median groove continuous with cleft in upper lip; nostril crescentic, its inner and lower margins swollen, forming an ill-defined, wart-like excrescence below. Feet moderately large, with no special peculiarities of form. Front foot with inner digit reduced to a mere tubercle with rudimentary nail not extending to its edge; outer digit slightly shorter than second, the third and fourth sub-equal, slightly longer than second; pads five, large, distinct, that at base of outer toe with slightly developed supplemental tubercle at outer base. Hind foot with inner digit extending to middle of first phalanx of second digit, outer digit somewhat longer, the second, third and fourth sub-equal and longest; pads six, the postero-internal more than twice as long as broad, widest in front, narrowing posteriorly, the postero-external well developed, fully one-third as large as that at base of outer toe; pads at bases of inner and outer toes with rudimentary supplemental outer tubercles; surface of sole naked, smooth except between pads, where it is noticeably wrinkled. Claws simple, curved, those on hind feet largest. Tail slightly four-sided, uniformly and very thinly haired throughout, the tip with no distinct pencil; annulations well

defined, regular, about nine to the centimeter at middle; length of hairs equal to about one and one-half width of rings. Fur soft but interspersed with numerous coarse hairs which impart to it a somewhat harsh quality; with a lens these coarse hairs are seen to be very slender bristles, distinctly grooved on the upper side. Mammæ: $p\ 2-2$, $i\ 3-3=10$.

Colour.—The two main types of colour are (1) dark slaty, becoming almost blackish on back, and (2) light brown above, pale buff or light grey below. All possible intermediate stages exist connecting the two extremes.

Skull.—In general features the skull shows no marked peculiarities. Dorsal profile faintly convex throughout, but

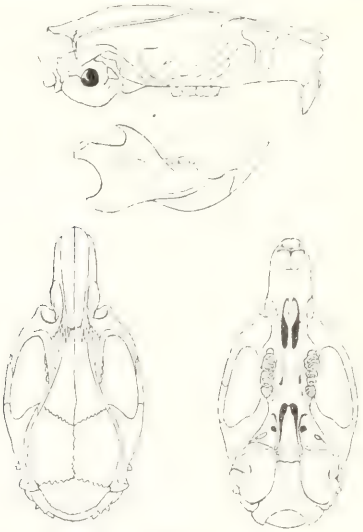


FIG. 172.

Epimys rattus. Nat. size.

flattened over posterior half of nasals, between orbits and on posterior half of brain-case; occiput squarely and almost perpendicularly truncate; ventral profile nearly flat. Brain-case squarish in outline when viewed from above, but slightly longer than wide and somewhat narrowed posteriorly, the sides of its upper surface marked by conspicuous longitudinal ridges continuous with the overhanging interorbital beads. The greatest width of brain-case across these ridges is distinctly greater than length of parietal measured along ridge. No trace of sagittal crest, but a low ridge-like lambdal crest present in old individuals and

a knife-like median occipital crest from interparietal to foramen magnum. Interparietal large, its anterior border nearly straight, though usually forming a median point, its posterior border strongly convex. Occiput rather broad and low when viewed from behind, but central portion of brain-case not rising conspicuously above it; paroccipital processes slender and rather long, extending beyond level of lower lip of foramen. Floor of brain-case with no special features; width of basioccipital along anterior border scarcely half median length; auditory bulla moderately large, evenly inflated, its greatest diameter about 8 mm., meatus with thickened edges but not tubular. Interorbital region contracted, its least breadth less than that of rostrum over roots of incisors, its margin overhanging and conspicuously beaded, the beads passing into lateral ridges of brain-case behind a slight though evident angle at suture between frontal and parietal. Zygoma rather slender, not expanded or noticeably flattened, strongly bent downward, its lowest point usually opposite m^3; anteriorly the arches are not abruptly spreading, so that greatest zygomatic breadth is at glenoid level; plate forming outer border of anteorbital foramen well developed, its anterior border vertical below, broadly rounded above. Rostrum much deeper than broad but without special peculiarities of form; nasals truncate or bluntly pointed posteriorly, extending barely to lachrymal level, somewhat exceeded by nasal branches of premaxillaries. Incisive foramina parallel sided, rather short and wide, their posterior border extending to level of anterior root of m^1, their anterior extremity falling short of incisors by a distance equal to about one and one-half times the width of the two foramina together. Palate extending noticeably behind level of m^3. Mesopterygoid space slightly wider posteriorly than anteriorly, truncate or double rounded in front, the hamulars slightly turned outward, not in contact with bullæ; ectopterygoid well developed, tilted noticeably upward from within outward (skull viewed from below). Mandible robust, with no special peculiarities; coronoid process directed strongly backward, slightly curved, its extremity rising noticeably above level of condyle.

Teeth.—Teeth moderately large relatively to size of skull; upper molars with outer tubercles well developed, nearly as large as those on inner side, the crescents rather flat but evident and showing little tendency to distortion. Incisors strongly compressed, without special peculiarities, the cutting surface of upper tooth vertical, flat, its edges entire. First upper molar 5-rooted, the anterior root largest, strongly projecting forward beyond base of crown, the median inner and median outer roots smallest; crown barely as long as that of m^2 and m^3 together, its area about equal to that of the succeeding teeth; anterior border of crown smooth, with no trace of cingulum or minute supplemental cusps; first lamina moderately and evenly crescentic,

the outer tubercle nearly as large as *t*1, and only a little anterior to it in position, both small tubercles well defined from *t*2, the re-entrant angles deep and without supplemental folds; second lamina essentially like first, not connected with it by longitudinal ridges, *t*6 entire; third lamina completely distinct from second, *t*9 well developed, about as large as *t*3, *t*7 absent. Second upper molar with first lamina represented by large *t*1; second and third laminæ essentially as in m^1, the third with well developed *t*9 nearly as large as that of preceding tooth and marked off from *t*8 by a distinct re-entrant angle. Third upper molar with large, distinct, terete *t*1, small *t*4 and *t*5, the latter joined by an obsolete *t*6 to outer extremity of *t*8, the only remnant of the third lamina; as the crown wears away the second and third laminæ assume the form of a narrow loop, the two limbs of which are separated by a deep re-entrant angle. Anterior lower molar with crown scarcely as long as those of the two succeeding teeth, its area also less; first lamina narrower than second, its posterior border nearly straight, its anterior border with deep re-entrant angle on outer side of middle; second and third laminæ essentially alike, more strongly curved posteriorly than anteriorly, the division into two tubercles ill defined; terminal heel small, compressed; a small terete tubercle usually present at outer edge of space between second and third laminæ, and a similar though smaller tubercle occasionally present in that between first and second. Second lower molar essentially like first without anterior lamina, the outer border with small supplemental tubercle at anterior base of first lamina, and another usually less well developed in space between laminæ. Third lower molar with two laminæ, the anterior of which shows a faint indication of division into two tubercles, the posterior similar to the posterior heel of the other teeth but considerably larger.

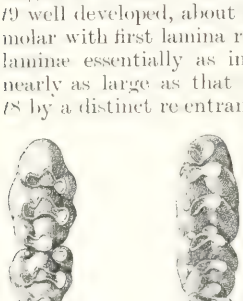


FIG. 173.

Epimys rattus. Cheek-teeth. ×3.

Remarks. Though now so completely intermingled in many localities that exact determination of specimens is often impossible, there seems no good reason to doubt that two geographical races of *Epimys rattus* have established themselves in western Europe. True *rattus*, the blackish, slaty-bellied form, is a northern animal, normally occurring in a climate similar to that of central and northern Europe. The buff-bellied form, *Epimys rattus alexandrinus*, is normally more southern in its range, finding its optimum conditions, so far as Europe is concerned, in the Mediterranean region.* Individuals of each

* In the United States it appears never to become naturalized north of the limits of the Lower Austral life zone, while *E. rattus* is or has been locally common in the Transition and Canadian zones.

form have been artificially though unintentionally transplanted into the area of the other, and to this circumstance, rather than to individual variation or normal intergradation, should be attributed the intermediate specimens now so abundantly found.

Epimys rattus rattus Linnæus.

1758. [*Mus*] *rattus* Linnæus, Syst. Nat., I, 10th ed., p. 61 (Sweden).
1833. *Mus tectorum* var. *fuliginosus* Bonaparte, Iconogr. Faun. Ital., I, fasc. 3, pl. 22, fig. 1, name on plate only (Italy, no exact locality).
1842. *Mus subæruleus* Lesson, Nouv. Tabl. du Règne Anim., Mamm., p. 138 (Rochefort, Charente-Inférieure, France).
1857. *Mus rattus* Blasius, Säugethiere Deutschlands, p. 317.
1867. *Rattus domesticus* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LVI, pt. I, p. 64 (Substitute for *rattus*).
1867. [*Rattus domesticus*] *fuscus* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LVI, pt. I, p. 64 (Germany).
1867. [*Rattus domesticus*] *varius* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LVI, pt. I, p. 64 (Germany).
1867. [*Rattus domesticus*] *fulvaster* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LVI, pt. I, p. 64 (Austria and Germany).
1867. [*Rattus domesticus*] *albus* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LVI, pt. I, p. 65 (Austria, Hungary, Germany).
1867. [*Rattus domesticus*] *ater* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, LVI, pt. I, p. 65 (Germany).
1902. *Mus alexandrino-rattus* Fatio, Revue Suisse de Zoologie, X, p. 402, December 30, 1902 (Ticino, Switzerland). See Mottaz, Bull. Soc. Zool. de Genève, I, p. 163, November 15, 1908.
1905. *Mus rattus ater* Millais, Zoologist, 4th ser., IX, p. 205, June, 1905 (London, England). Type in British Museum.
1908. *Epimys rattus* Satunin, Mitth. Kauk. Mus., Tiflis, IV, Lief. 1 2, p. 112.
1910. *Mus* (*Epimys*) *rattus* and *M.* (*E.*) *rattus ater* Trouessart, Faune Mamm. d'Europe, p. 143.

Type locality.—Upsala, Sweden.

Geographical distribution.—Europe north of the Mediterranean region; occurring in isolated colonies and everywhere being replaced by *Epimys norvegicus*.

Diagnosis.—General colour slaty, the back darker, frequently almost black.

Measurements.—Adult male and female from South Ronaldshay, Orkney Islands: head and body, 189 and 188; tail, 206 and 205; hind foot, 36·7 and 36; ear, 24·5 and 24. Adult male from Lundy Island, Devonshire: head and body, 209; tail, 233; hind foot, 40; ear, 25·5. Adult male from London, England (type of *ater* Millais): head and body, 235;* tail, 235;*

* From Millais.

hind foot, 36 ; ear, 25.* Adult female from Hatszeg, Hunyad, Austria-Hungary : head and body, 190 ; tail, 225 ; hind foot, 38. For cranial measurements see Table, p. 856.

Specimens examined.—Twenty, from the following localities :—
Scotland : South Ronaldshay, Orkney Islands, 5 (Edinburgh).
England : Great Yarmouth, Norfolk, 1; Tring, Hertfordshire, 1; London, 6 (including type of *ater* Millais); Lundy Island, Devonshire, 2.
France : Sark, Channel Islands, 1.
Switzerland : No exact locality, 1.
Austria-Hungary : Hatszeg, Hunyad, 2.
Portugal : San Miguel, Azores, 1.

♂ st.	Great Yarmouth, Norfolk, England.	W. R. Butterfield (c & p).	4. 1. 22. 1.
♀ st.	Tring, Hertfordshire.	Hon. N. C. Rothschild (c & p).	1. 5. 22. 8.
2 st.	London.	A. Stedall (c & p).	
♂, 1 al.	London.	C. J. Wilson (c & p).	86. 4. 5. 1-2.
st.	London.	E. Bidwell (c & p).	2. 4. 4. 1.
♂.	London.	J. G. Millais (p). (Type of *ater* Millais.)	5. 7. 28. 1.
2 ♂.	Lundy Island, Devonshire.	T. A. Coward (c & p).	7. 12. 19. 1-2.
♀.	Switzerland. (*Nager.*)	E. R. Alston (p).	79. 9. 25. 40.
♂, ♀.	Hatszeg, Hunyad, Transylvania.	C. G. Danford (c).	3. 2. 2. 22-24.
♂.	San Miguel, Azores. (*W. R. O. Grant.*)	Hon. W. Rothschild (p).	3. 6. 5. 15.

Epimys rattus alexandrinus Geoffroy.

1803. *Mus alexandrinus* Geoffroy, Catal. Mammif. du Mus. Nat. d'Hist. Nat., Paris, p. 192 (Egypt).
1814. *Musculus frugivorus* Rafinesque, Précis des Découv. et Travaux Somiologiques, p. 13 (Sicily).
1825. *Mus tectorum* Savi, Nuovo Giorn. de' Letterati, Pisa, x, p. 74 (Pisa, Italy).
1827. *Myoxus siculæ* Lesson, Man. de Mammalogie, p. 274 (Substitute for *Musculus frugivorus* Rafinesque).
1841. *Mus sylvestris* Pictet, Mém. Soc. Phys. et d'Hist. Nat., Genève, ix, p. 153 (Near Geneva, Switzerland). Alternative for *leucogaster*.
1841. *Mus leucogaster* Pictet, Mém. Soc. Phys. et d'Hist. Nat., Genève, ix, p. 154 (Near Geneva, Switzerland).
1841. [*Mus*] *nemoralis* de Sélys-Longchamps, Atti della seconda Riunione degli Scienziati Italiani, Torino, 1840, p. 247 (Near Geneva, Switzerland). Accidental substitute for *sylvestris* Pictet.
1845. *Mus piciteti* Schinz, Synops. Mamm., ii, p. 142 (Substitute for *leucogaster* Pictet).
1857. *Mus alexandrinus* Blasius, Säugethiere Deutschlands, p. 316.
1882. [*Mus rattus*] *intermedius* Ninni, Atti del reale Inst. Veneto, 5th ser., vii, p. 574 (Venice, Italy).
1910. *Mus* (*Epimys*) *rattus intermedius* and *M.* (*E.*) *rattus alexandrinus* Trouessart, Faune Mamm. d'Europe, pp. 143, 144.

Type locality. Alexandria, Egypt.
Geographical distribution.—Mediterranean region ; everywhere abundant and not tending to be replaced by *Epimys norvegicus*.

* From Millais.

Diagnosis.—Upper parts light brown; underparts strongly contrasted pale buff or light grey.

Measurements.—Two adult females from near Nimes, Gard, France: head and body, 180 and 199; tail, 222 and 250; hind foot, 36·5 and 38·5; ear, 24 and 27. Two females from Sorrento, Italy: head and body, 177 and 178; tail, 243 and 217; hind foot, 37 and 37. Average and extremes of ten adults from Sorrento, Italy: head and body, 190·7 (181–202); tail, 221 (203–244); hind foot, 36 (35–37). Average and extremes of six adults from Palermo, Sicily: head and body, 202·5 (196–216); tail, 234 (220–258); hind foot, 35·8 (34–38). Female from Silos, Burgos, Spain: head and body, 176; tail, 200; hind foot, 36; ear, 26. For cranial measurements see Table, p. 856.

Specimens examined.—One hundred and twenty-three, from the following localities:—

England: Sunderland, Durham (on ship), 1; Lundy Island, Devonshire, 6.

Spain: Pajáres, Leon, 2; Arrechavaleta, Vitoria, 2; Béjar, Salamanca, 2; Silos, Burgos, 4; Castrillo de la Reina, Burgos, 1; Jerez, 2; Venta del Baul, Granada, 1; Alcoy, Alicante, 1; Barracas, Castellon, 1; Panticosa, Huesca, 1; San Cristobal, Minorca, Balearic Islands, 2.

France: Biarritz, Basses-Pyrénées, 7; near Nimes, Gard, 17; Agay, Var, 3; Barcelonnette, Basses-Alpes, 1 (U.S.N.M.).

Switzerland: Lugano, Ticino, 1 (U.S.N.M.); Agra, Ticino, 1 (U.S.N.M.).

Italy: Giamutri Island, Tuscany, 1; Florence, 9 (U.S.N.M.); Palermo, Sicily, 30 (B.M. and U.S.N.M.); no exact locality, 1.

Montenegro: No exact locality, 3.

Greece: Corfu, 3; Argostoli, Cephalonia, 14; Kephissia, Athens, 4; Canea, Crete, 2.

♂.	Sunderland, Durham (on board ship), England.	W. B. Tegetmeier (P).	89. 1. 28. 1.
3 ♂, 2 ♀.	Lundy Island, Devonshire.	T. A. Coward (C & P).	7. 12. 19. 3–6.
♂, ♀.	Pajáres, Leon, Spain. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 98–99.
♂, ♀.	Arrechavaleta, Vitoria. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 94–95.
2 ♀.	Béjar, Salamanca. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 96–97.
2 ♂.	Silos, Burgos.	N. & S. Gonzalez (C).	8. 7. 7. 22–23.
♂.	Castrillo, Burgos.	N. & S. Gonzalez (C).	8. 7. 7. 24.
♂, ♀.	Jerez, Cadiz.	A. Chapman (P).	8. 3. 26. 3–4.
♀.	Alcoy, Alicante. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 101.
♂.	Barracas, Castellon. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 102.
♀.	Panticosa, Huesca. (*N. Gonzalez.*)	O. Thomas (P).	8. 2 9. 100.
♂, ♀.	San Cristobal, Minorca, Balearic Islands.	O. Thomas and R. I. Pocock (C & P).	0. 7. 1. 50–51.
♂, ♀.	Biarritz, Basses-Pyrénées, France.	J. F. Davison (C & P).	6. 1. 21. 1–2.
♂, 2 ♀.	Agay, Var.	G. S. Miller (C).	8. 8. 4. 224–226.
♀.	Giamutri Island, Tuscany.	Genoa Museum (E).	7. 2. 28. 3.
1.	Italy (Savi).	Crisp Collection.	84. 6. 3. 6.
♂, 3 ♀.	Palermo, Sicily.	J. I. S. Whitaker (C & P).	98. 10. 6. 8–11.

CRANIAL MEASUREMENTS OF *EPIMYS RATTUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Occipital breadth.	Depth of braincase at middle.	Nasal.	Diastema.	Mandible.	Maxillary toothrow.	Mandibular toothrow.	Observations.
E. rattus rattus.													
Scotland: Orkney Islands .	1907. 21*	♀	38·8	20·0	5·8	15·8	11·2	14·0	10·6	24·0	7·0	6·8	Teeth slightly worn.
,, ,, .	1908. 46*	♀	39·2	20·4	6·0	16·6	11·8	14·8	10·2	24·2	7·0	6·6	,, ,,
England: London. . .	5. 7. 28. 1†	♂	45·0	22·0	6·4	17·2	12·2	17·0	13·0	28·0	7·0	6·4	,, moderately worn.
E. rattus alexandrinus.													
Spain: Alcoy, Alicante . .	8. 2. 9. 101	♀	40·0	20·2	6·0	16·0	11·2		11·0	25·0	6·8	6·2	,, ,,
Barracas, Castellon .	8. 2. 9. 102	♂	40·0	20·0	6·4	16·2	12·0	16·0	11·4	24·8	6·6	6·2	,, much worn.
Panticosa, Huesca .	8. 2. 9. 100	♀	40·4	19·8	6·2	16·2	11·0	15·4	11·2	24·6	6·4	6·2	,, ,,
Arrechavaleta, Vitoria	8. 2. 9. 95	♂	39·2	21·0	6·4	16·0	11·6	14·2	11·0	24·4	7·0	6·6	,, ,,
Silos, Burgos . .	8. 7. 7. 22	♂	42·0	21·4	6·0	16·4	11·6	15·8	12·0	25·2	7·4	7·0	,, ,,
,, ,, . .	8. 7. 7. 23	♂	41·0	20·4	5·8	16·0	11·4	16·4	11·8	25·4	7·0	6·6	,, moderately worn.
Béjar, Salamanca .	8. 2. 9. 96	♀	38·4	20·6	6·0	16·0	11·0	15·2	11·0	24·4	6·8	6·4	,, much worn.
,, ,, .	8. 2. 9. 97	♀	39·6	21·0	6·0	16·4	11·4	15·2	11·4	25·0	7·0	6·8	,, ,,
Pajáres, Léon . .	8. 2. 9. 98	♂	41·4	—	5·8	17·0	11·2	16·2	11·8	25·8	7·2	6·8	,, moderately worn.
France; near Nimes, Gard .		♀	41·0	22·0	5·8	17·2	12·4	16·0	11·6	24·8	7·2	6·6	,, ,,
Barcelonnette, Basses-Alpes . . .	103384	♂	43·0	21·4	6·8	17·0	12·0	16·0	12·0	26·2	6·8	7·0	,, ,,

Switzerland: Agra Ticino .	121229	♀	39·8	20·0	5·8	16·0	11·6	14·2	11·0	24·2	6·8	6·8	Teeth moderately worn.
Italy: Florence . . .	103338	♀	38·2	19·2	6·0	15·8	11·0	15·2	10·8	23·8	6·8	6·6	,, much worn.
,, . . .	103343	♂	38·8	19·8	6·2	16·0	10·8	14·4	10·6	23·6	6·6	6·4	,, ,,
Sorrento . . .	103101	♂	39·2	20·0	6·0	15·8	11·2	15·4	11·2	24·4	7·0	6·8	,, ,,
,, . . .	103102	♂	38·8	20·2	6·2	15·2	11·4	15·2	11·0	24·0	6·6	6·4	,, moderately worn.
,, . . .	103114	♂	41·0	20·4	6·0	16·0	11·8	16·0	11·2	25·4	7·2	7·0	,, ,,
,, . . .	103116	♂	38·0	20·0	6·0	15·0	11·8	15·0	10·4	23·8	6·8	6·6	,, ,,
,, . . .	103122	♂	41·2	20·4	6·2	16·0	11·6	15·2	11·2	24·4	7·2	7·0	,, ,,
,, . . .	103123	♂	38·2	19·4	5·8	15·2	11·2	14·0	10·8	23·2	7·0	6·8	,, ,,
,, . . .	103103	♀	40·0	20·2	5·8	16·4	11·6	15·0	10·6	25·0	7·4	7·0	,, ,,
,, . . .	103104	♀	40·4	20·2	5·8	15·4	11·2	15·4	11·2	24·6	7·0	7·0	,, much worn.
,, . . .	103105	♀	39·0	20·0	5·6	16·0	11·4	15·0	10·8	25·4	7·0	6·8	,, ,,
,, . . .	103108	♀	41·2	—	6·2	16·2	11·2	15·4	10·6	25·2	7·2	7·0	,, ,,
,, . . .	103109	♀	41·0	—	5·8	16·0	10·8	15·2	11·0	25·2	7·2	6·8	,, moderately worn.
,, . . .	103115	♀	43·0	21·2	6·2	17·2	12·6	16·4	12·0	26·8	7·4	7·2	,, much worn.
,, . . .	103117	♀	43·2	21·4	5·8	16·4	12·4	16·0	11·8	26·0	6·8	6·8	,, ,,
,, . . .	103118	♀	41·8	20·0	6·0	16·2	11·6	15·6	11·8	26·0	7·0	6·8	,, moderately worn.
,, . . .	103120	♀	41·2	21·2	5·8	16·2	11·0	15·2	11·4	25·8	7·2	6·8	,, ,,
,, . . .	103121	♀	41·6	20·4	6·2	16·4	11·8	15·0	11·8	25·4	7·2	7·0	,, ,,
,, . . .	103125	♀	40·8	20·2	6·0	15·8	11·4	15·4	11·2	25·0	7·0	6·8	,, ,,
,, . . .	103126	♀	41·8	20·2	6·2	16·8	11·8	16·4	11·8	25·6	7·0	7·0	,, ,,
,, . . .	103127	♀	43·4	21·2	6·8	16·6	12·4	16·6	12·4	27·0	7·4	7·2	,, much worn.
,, . . .	103128	♀	39·8	21·0	6·2	16·2	11·4	15·2	10·4	25·0	7·0	7·0	,, moderately worn.
Sicily: Palermo . . .	103175	♂	39·2	20·4	6·0	15·8	11·4	15·4	11·4	25·4	6·6	6·8	,, much worn.
,, . . .	103167	♀	42·0	21·6	6·0	17·0	11·8	15·6	11·4	24·2	7·2	6·8	,, ,,
,, . . .	103177	♀	42·2	21·2	6·0	17·2	11·2	16·4	12·0	26·2	6·8	6·4	,, ,,
,, . . .	103179	♀	41·6	20·4	6·0	16·8	11·4	15·8	12·0	25·8	6·8	6·8	,, ,,
,, . . .	103186	♀	39·8	20·2	6·2	16·0	11·4	15·4	11·4	24·0	7·0	6·6	,, ,,

* Royal Scottish Museum, Edinburgh. † Type of *uter* Millais.

3 ♂.	Montenegro. (*L. Führer.*)	O. Thomas (P).	5. 8. 4. 7–9.
5 ♂, 5 ♀.	Argostoli, Cephalonia, Greece. (*C. Mottaz.*)	J. I. S. Whitaker (P).	8. 10. 1. 31–37. 40–42.
3 ♂, ♀.	Kephissia, Athens. (*C. Mottaz.*)	Hon. N. C. Rothschild (P).	8. 10. 2. 40–43.
♂, ♀.	Canea, Crete. (*C. H. B. Grant.*)	A. Trevor Battye (P).	8. 10. 24. 4–5.

EPIMYS NORVEGICUS Erxleben.

1777. *Mus norvegicus* Erxleben, Syst. Regni Anim., I, p. 381 (Norway).
1778. *Mus decumanus* Pallas, Nov. Spec. Quadr. Glir. Ord., p. 91 (Europe).
1779. *M[us] surmolottus* Severinus, Tentamen Zool. Hungaricæ, p. 73 (Central Europe).
1800. *M[us] decumanus hybridus* Bechstein, Pennant's Allgem. Uebersicht d. Vierfüss. Thiere, II, p. 713, described on p. 497. Waltershausen, Germany (melanistic specimen).
1816. *Mus caspius* Oken, Lehrb. d. Naturgesch., III, pt. II, p. 895. (Alternative for *decumanus*.)
1837. *Mus hibernicus* Thompson, Proc. Zool. Soc., London, p. 52 (Rathfriland, Co. Down, Ireland).
1857. *Mus decumanus* Blasius, Säugethiere Deutschlands, p. 313.
1900. *Mus norvegicus* Rehn, Proc. Biol. Soc., Washington, XIII, p. 167, October 31, 1900.
1908. *Epimys norwegicus* Satunin, Mitth. Kauk. Mus., Tiflis, IV, Lief. 1–2, p. 111.
1910. *Mus* (*Epimys*) *norvegicus* and *M.* (*E.*) *norvegicus hibernicus* Trouessart, Faune Mamm. d'Europe, p. 142.

Type locality. Norway.

Geographical distribution.—Originally confined to the north temperate portions of the Old World; now essentially cosmopolitan through artificial dispersal.

Diagnosis.—Skull with brain-case rather narrow, its greatest breadth across lateral ridges about equal to length of parietal measured along ridge; anterior upper molar with evident cingulum at anterior border of crown; first lamina of m^1 without distinct outer tubercle; terminal heel of m^2 with no outer tubercle; first and second lower molars usually without evident supplemental cusps at outer extremity of furrows; form robust; tail decidedly shorter than head and body; ear when laid forward barely or not reaching eye; hind foot of adult usually over 40 mm. in length, condylobasal length of adult skulls usually 45 to 54 mm.

External characters.—Size larger and form more robust than in *E. rattus*, the tail never as long as head and body. Ear short, extending barely or not to eye when laid forward, its substance thick and opaque, its surface densely covered with fine short hairs, its form not peculiar. Feet more robust than in *E. rattus*, but proportions of toes and number and position of tubercles the same. In size the tubercles are, however, relatively smaller than

those of *E. rattus*, especially on the hind foot. Except for its greater diameter and relative shortness the tail is essentially like that of *E. rattus*, though the rings tend to be less well defined owing to the greater distinctness of the individual scales of which they are composed. Fur less harsh in quality than that of *E. rattus*, owing to the less abundance of grooved bristles and the excessive slenderness of such of these hairs as occur. Mammæ: $p\ 2-2$; $a\ 1-1$; $i\ 3-3=12$.

Colour.—Upper parts a coarse, variable mixture of dull ochraceous-buff and slaty grey, the back darker than the sides and heavily "lined" (though rarely clouded) with black. Occasionally there is a decided tinge of russet on posterior half of back. Underparts greyish white, usually with an inconspicuous wash of cream-buff. Ear dull hair-brown. Feet concolor with underparts. Tail obscurely bicolor, the hairs blackish above, whitish below, the skin everywhere distinctly appearing at surface.

Skull.—Brain-case narrow and almost sub-cylindrical in aspect, the lateral ridges evident but not greatly developed; width of

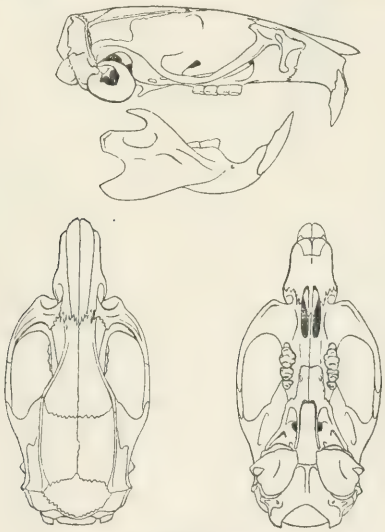


FIG. 174.
Epimys norvegicus. Nat. size.

brain-case across ridges about equal to outer length of parietal; interparietal with convexity of anterior and posterior borders sub-equal, seldom if ever showing the conspicuous contrast normally present in *E. rattus*; width of basioccipital along anterior border decidedly more than half median length.

Rostrum deepened anteriorly so that dorsal profile is nearly horizontal throughout. Upper border of plate forming outer wall of infraorbital foramen nearly horizontal and very abruptly rounded off anteriorly, the plate wider in proportion to its height than in *Epimys rattus*. In other respects the skull closely resembles that of *E. rattus* apart from its larger general size. The auditory bullæ tend, however, to be less inflated and the incisive foramina to be slightly shorter and wider, their posterior border usually not extending quite to level of anterior molar root.

Teeth.—Incisors as in *E. rattus*. Molars with number of roots and general size and proportions of crowns as in *E. rattus*, but upper teeth showing a greater tendency toward reduction of the outer cusps. First upper molar with distinct cingulum-like ridge at anterior base of crown, this ridge in some specimens showing a tendency to develop one or more minute tubercles; first lamina noticeably distorted by the nearly complete suppression of *t*3, which is so reduced as to be practically nothing more than an outward prolongation of the outer border of *t*2, usually without trace of antero-external re-entrant angle; second and third laminæ essentially as in *Epimys rattus*. Second upper molar like that of *E. rattus* except that *t*9 is greatly reduced in size and completely merged in outer base of *t*8, the third lamina thus forming a simple biconvex terminal heel. Third upper molar essentially as in *Epimys rattus*, *t*1 equally well developed, but other elements of tooth less distinct. Lower molars differing from those of *Epimys rattus* in the less evident tendency to develop supplemental tubercles at outer extremities of spaces between the laminæ, such rudiments of the small tubercles as may be present usually appearing as slight thickenings at outer extremities of the laminæ.

FIG. 175.

Epimys micrurus. Cheek teeth. × 3.

Measurements.—Adult male from Cortachy, Forfar, Scotland: head and body, 226; tail, 179; hind foot, 415; ear, 20. Adult male from Cambridge, England: head and body, 242; tail, 185; hind foot, 42. Adult male from Tiverton, Devonshire, England: head and body, 238; tail, 212; hind foot, 42; ear, 21. Adult male from Roydon, Norfolk, England: head and body, 250; tail, 218; hind foot, 45. Adult male from Hampton, near London, England: head and body, 255; tail, 187; hind foot, 41; ear, 20·5. Adult male from Kilmanock, Waterford, Ireland: head and body, 242; tail, 209; hind foot, 44; ear, 20. Adult male and female from Upsala, Sweden: head and body, 250 and 252; tail, 183 and 183; hind foot, 41 and 41. Adult male and

female from Palermo, Sicily: head and body, 242 and 222; tail, 200 and 186; hind foot, 45 and 43. For cranial measurements see Table, p. 862.

Specimens examined.—One hundred and thirty-five, from the following localities:—

Scotland: Stockbriggs, Lanarkshire, 2; Cortachy, Forfar, 2 (Wilson).

England: Doncaster, Yorkshire, 1; East Norfolk Marshes, 2; West Norfolk, 1; Roydon, Norfolk, 1; Lowestoft, Suffolk, 1; Barrow, Suffolk, 1 (U.S.N.M.); Swithland, Leicestershire, 1; Cambridge, 2; Epping Forest, Essex, 1; Hampton, Middlesex, 3; Tiverton, Devonshire, 1; Northlew, Devonshire, 1; Lundy Island, Devonshire, 2; Isle of Man, 1.

Ireland: Castle Hamilton, Cavan, 1; Ballaghmoon, 1; Kilmanock, Wexford, 8; Inch, Wexford, 1; Stokestown, Wexford, 1; Clare Island, Mayo, 2; Inishmore, Arran Islands, 2; Co. Wicklow, 1; Castle Hamilton, 1.

Norway: Holme, Mandal, 6.

Sweden: Upsala 8 (U.S.N.M.); Stockholm, 1 (U.S.N.M.).

France: Trinity, Jersey, 1; St. Martins, Guernsey, 1; Étupes, Doubs, 1; Barcelonnette, Basses-Alpes 1 (U.S.N.M.); St. Gilles, Gard, 2; Forest of Bouconne, Gers, 1; Montréjeau, Haute-Garonne, 2 (U.S.N.M.); Biarritz, Basses-Pyrénées, 4; Cadillac, Gironde, 2 (U.S.N.M.).

Spain: Pajares, Leon, 3; Béjar, Salamanca, 6; Silla, Vallencia, 5; Alcoy, Alicante, 4; Elche, Alicante, 1.

Germany: Brunswick, 1 (U.S.N.M.); Moritzburg, Saxony, 1 (U.S.N.M.); Uebigau, Saxony, 2 (U.S.N.M.); Jena, Thüringen, 2; Nuremberg, Bavaria, 1 (U.S.N.M.); near Königsberg, 2 (U.S.N.M.).

Switzerland: Neuchatel, 1 (U.S.N.M.); Roggweil, Thurgau, 4; Bodensee, 1.

Italy: Palermo, Sicily, 26 (U.S.N.M.).

Greece: Corfu, 1; Argostoli, Cephalonia, 3.

2 ♂.	Stockbriggs, Lanarkshire, Scotland.	E. R. Alston (C & P).	79. 9. 25. 37. 87.
♂, ♀.	Clare Island, Mayo, Ireland. (*R. H. Bunting.*)	G. Barrett-Hamilton (P).	11. 1. 2. 142 143.
♂. ♀.	Inishmore, Aran Islands.	G. Barrett-Hamilton (P).	11. 1. 2. 144-145.
2 ♀.	East Norfolk, England. (*Dr. P. H. Emerson.*)	Dr. E. Hamilton (P).	96. 3. 28. 1-2.
♂.	Roydon, Norfolk.	Rev. T. C. Hose (C & P).	93. 11. 28. 1.
♂.	Swithland, Leicestershire.	Hon. F. A. Butler (C & P).	11. 1. 3. 416.
♀.	Epping Forest, Essex.	H. Doubleday (C & P).	46. 6. 15. 27.
♂.	Tiverton, Devonshire.	T. F. Tracey (C & P).	11. 1. 3. 417.
♂ juv, ♀.	Lundy Island, Devonshire.	T. A. Coward (C & P).	7. 12. 19. 7–8.
♂.	Kilmanock, Wexford. (*G. Barrett-Hamilton.*)	W. Eagle Clarke (P).	91. 9. 13. 1.
♂.	Kilmanock, Wexford.	G. Barrett-Hamilton (P).	11. 1. 3. 418.
♀.	Inch, Wexford.	G. Brooke (C & P).	9. 4. 13. 1.
♂.	Sulby Glen, Isle of Man.	C. H. B. Grant (C & P).	11. 1. 3. 419.
♂.	Holme, Mandal, 200 ft. Norway.	R. J. Cuninghame (C & P).	8. 8. 9. 13.
♀.	Trinity, Jersey, Channel Islands. (*R. H. Bunting.*)	O. Thomas (P).	8. 9. 2. 6.
♂.	St. Martins, Guernsey, Channel Islands. (*R. H. Bunting.*)	O. Thomas (P).	8. 9. 2. 22.
♀.	Étupes, Doubs, France. (*C. Mottaz.*)	O. Thomas (P).	8. 8. 10. 99.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Occipital breadth.	Occipital depth.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
Ireland: Co. Wicklow		♂	51·8	28·0	7·4	20·0	12±	20·0	13·8	31·0	7·2	7·0	Teeth moderately worn.
Castle Hamilton		♂	50·4	25·2	6·8	19·8	12·6	18·6	14·8	31·0	7·6	7·0	,, ,,
Scotland: Stockbriggs, Lanarkshire	79. 9. 25. 87	♂	47·0	23·0	6·4	18·0	11·0	18·2	12·8	29·0	7·6	7·4	,, ,,
England: Swithland, Leicestershire	11. 1. 3. 416	♂	52·0	28·6	7·2	20·4	12·6	20·2	15·4	31·0	7·8	7·2	,, ,,
Roydon, Norfolk	93. 11. 28. 1	♂	54·2	27·4	7·6	21·2	13·0	22·0	15·6	33·0	8·8	8·4	,, much worn.
Lowestoft, Suffolk		♂	52·0	28·4	7·4	21·0	13·4	21·0	14·4	33·0	8·6±	8·2	,, ,,
Cambridge		♂	49·4	25·8	7·0	19·0	12·0	19·4	14·6	29·4	7·6	7·4	,, moderately worn.
Hampton		♂	48·6	24·8	6·4	19·0	11·4	18·6	14·0	30·0	7·6	7·4	,, ,,
,,		♂	46·0	22·8	6·4	17·2	10·8	18·4	13·4	28·0	7·4	7·6	,, ,,
Northlew, Devonshire		♂	47·0	25·2	6·8	19·0	—	18·8	13·8	29·0	8·0	7·6	,, ,,
Tiverton ,,	11. 1. 3. 417	♂	47·0	21·2	6·4	19·2	11·4	18·2	13·4	28·4	7·4	7·2	,, ,,
Sweden: Upsala	85079	♂	49·8	21·0	7·2	19·0	11·4	19·8	14·6	29·2	7·4	7·2	,, much worn.
,,	85083	♂	46·6	23·2	7·2	18·2	11·0	18·6	13·4	28·8	7·4	7·2	,, ,,
,,	85085	♂	45·4	22·2	6·8	18·0	11·2	17 2	13·4	27·6	7·4	7·4	,, moderately worn.
,,	85078	♀	48·0	23·8	7·4	18·4	11·6	17·8	13·8	28·4	7·2	7·0	,, much worn.
,,	85081	♀	43·8	22·4	7·0			16·8	12·8	27·0	7·2	7·0	,, moderately worn.
,,	85082	♀	45·2	22·8	6·8	17·6	11·2	17·4	13·6	28·8	7·0	7·2	,, much worn.
France: St. Gilles, Gard	172149	♂	45·0	23·0	7·0	18·0	11·0	16·8	12·6	27·2	8 0	7·4	,, moderately worn.
,,	8. 8. 4. 223	♂	45·6	22·4	6·8	17·8	10·8	17·0	12·8	27·2	7·6	7·2	,, ,,
Cadillac, Gironde	86956	♂	46·8	—	7·2	18·8	11·6	17·8	14·0	29·0	6·8	7·0	,, much worn.
,, ,,	86957	♂	46·6	23·0	6·6	18·2	11·6	17·8	13·6	28·0	7·2	7·0	,, ,,
Montréjeau	86997	♂	43·6	20·8	6·2	17·0	10·8	16·4	12·8	26·0	7·4	7·0	,, moderately worn.
,,	86996	♀	44·8	23·2	6·8	19·0	11·4	17·6	12·6	28·2	7·4	7·2	,, much worn.
Biarritz, Basses-Pyrénées	6. 6. 4. 2	♀	47·0	21·2	7·0	18·4	12·0	17·0	14·0	29·0	7·4	7·2	,, ,,
Spain: Silla, Valencia	8. 2. 9. 91	♂	45·6	22·4	6 6	18·4	12·6	17·0	13·4	27 2	7·8	7·2	,, moderately worn.
Alcoy, Alicante	8. 2. 9. 89	♂	47·4	25·0	6·8	18·4	13·0	18 2	14·0	28·2	7·6	7·2	,, ,,
Germany: Brunswick	85618	♀	44·6	21·6	6·4	16·8	10·4	17·6	13·2	27·2	7·2	7·0	,, much worn.
Jena	94. 4. 4. 1	♂	51·0	27·0	7·0	19·6	—	20·4	15·2	30·6	7·2	7·0	,, moderately worn.
Sicily: Palermo	103135	♂	49·2	25·0	7·2	19·6	12·2	19·2	14·0	28·8	7·4	7·0	,, ,,
,,	103141	♂	43·4	20·2	6·2	16·2	10·4	17·2	12·0	26·2	6·8	6·8	,, ,,
,,	103147	♀	45·8	23 0	6·6	18·2	11·6	18·2	13·8	27·8	7·2	7·0	,, ,,

♂.	St. Gilles, Gard.	G. S. Miller (c).	8. 8. 4. 223.
♀.	Bouconne, Gers. (*A. Robert.*)	O. Thomas (p).	6. 4. 1. 39.
2 ♂, 2 ♀.	Biarritz, Basses-Pyrénées, 100 ft.	J. F. Davison (c & p).	6. 1. 21. 3–4. 6. 6. 4. 1–2.
♂.	Pajáres, Leon, Spain. (*N. Gonzalez.*)	O. Thomas (p).	8. 2. 9. 86.
♂, ♀.	Béjar, Salamanca. (*N. Gonzalez.*)	O. Thomas (p).	8. 2. 9. 87–88.
2 ♂, ♀.	Silla, Valencia. (*N. Gonzalez.*)	O. Thomas (p).	8. 2. 9. 91–93
♂, ♀.	Alcoy, Alicante. (*N. Gonzalez.*)	O. Thomas (p).	8. 2. 9. 89–90.
♂, ♀.	Jena, Thüringen, Germany.	Prof. K. von Bardeleben (p).	94. 4. 4. 1 2.
2 ♂, 2 ♀.	Roggwil, Thurgau, Switzerland. (*E. H. Zollikofer.*)	O. Thomas (p).	2. 8. 4. 39–42
♂.	Bodensee, Switzerland. (*E. H. Zollikofer.*)	O. Thomas (p.)	2. 8. 4. 38.
♀.	Corfu, Greece. (*C. Mottaz.*)	J. I. S. Whitaker (p).	8. 10. 1. 30.
2 ♀.	Argostoli, Cephalonia. (*C. Mottaz.*)	J. I. S. Whitaker (p).	8. 10. 1. 38–39.

Genus **MUS** Linnæus.

1758. *Mus* Linnæus, Syst. Nat., I, 10th ed., p. 59 (*musculus*, by tautonymy).

1814. *Musculus* Rafinesque, Précos des Découv. et travaux Somiologiques, p. 13 (Substitute for *Mus*).

1837. *Leggada* Gray, Charlesworth's Mag. Nat. Hist., I, p. 586, November, 1837 (*L. booduga* Gray and *Mus platythrix* Bennett).

1844. *Drymomys* Tschudi, Fauna Peruana, p. 178 (*D. parvulus* Tschudi = *Mus musculus* Linnæus. See Palmer, Index Gen. Mamm., p. 246, 1904).

1857. *Mus* Blasius, Säugethiere Deutschlands, p. 309 (part).

1876. *Nannomys* Peters, Monatsber, k. preuss. Akad. Wissensch. Berlin, p. 480, August, 1876 (*N. setulosus* Peters).

1881. *Acromys* Trouessart, Bull. Soc. d'Études Sci. d'Angers, X, p. 133 (Synonym of *Drymomys* wrongly attributed to Wagner. See Palmer, Index Gen. Mamm., p. 246).

1896. *Pseudoconomys* Rhoads, Proc. Acad. Nat. Sci., Philadelphia, p. 531, December 8, 1896. *Mus* (*Pseudoconomys*) *proconodon* Rhoads.

1900. *Dryomys* Philippi, An. Mus. Nac. de Chile, XIV, p. 20 (modification of *Drymomys* Tschudi).

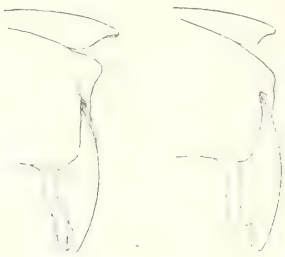
1910. *Mus* Miller, Proc. Biol. Soc. Washington, XXIII, p. 59, April 19, 1910.

Type species.—*Mus musculus* Linnæus (by tautonymy).

Geographical distribution. Originally confined to the tropical and temperate portions of the Old World; now essentially cosmopolitan through artificial dispersal of the type species.

Characters.—In general like *Epimys*, but mechanical scheme of molars modified by the elongation of crown of anterior tooth until it forms the main portion of tooth-row; m^1 with three roots, its crown decidedly longer than those of two succeeding teeth combined, its first lamina much distorted by the displacement backward of *t*1 into line with *t*5 and *t*6; m^3 small and

tending to disappear, in some species without trace of first lamina; upper incisor compressed, set at such an angle that a



a *b*

Fig. 156.
Upper incisor of *Epimys rattus* (*a*) and *Mus* (*b*).
Much enlarged.

sub-apical notch is normally cut in its outer side by action of lower tooth.

Remarks.—The genus *Mus* as now restricted contains the *Mus musculus* group and the Asiatic and African species usually referred to *Leggada*. Though the species differ considerably among themselves in details of structure the group is very homogeneous as regards the peculiar specialization of the mechanics of the molars and the distortion of the first lamina of m^1. About twenty-five forms are now known, seven of which occur in Europe.

KEY TO THE EUROPEAN FORMS OF *MUS*.

Hind foot broad and robust, its width at base of outer toes 4 to 5 mm.
- Condylobasal length of skull in adults 21·6 to 22·2 mm.; hind foot 17·4 to 18·8 mm. (St. Kilda Island, Scotland) ..... *M. norvalis*, p. 871.
- Condylobasal length of skull in adults 23 to 23·4 mm; hind foot 19 to 20 mm. (Faeroes)... *M. faeroensis*, p. 875.

Hind foot narrow and slender, its width at base of outer toes about 3 mm.
- Tail about as long as head and body, often longer, rarely much shorter; colour of underparts usually greyish, rarely contrasted with that of sides; condylobasal length of skull frequently more than 21 mm.; hind foot usually 17 to 19 mm. (House mice) ..... *M. musculus*, p. 865.
  - General colour dark and brownish, usually without evident yellowish tinge, the belly dusky greyish (central and northern Europe) ..... *M. m. musculus*, p. 869.
  - General colour light, usually with a decided yellowish tinge, the belly buffy greyish (Mediterranean region) ..... *M. m. azoricus*, p. 871.

Tail noticeably shorter than head and body (exceptions very rare); colour of underparts usually whitish in abrupt contrast with that of sides; condylobasal length of skull rarely attaining 21 mm.; hind foot usually 15 to 17 mm. (Field mice, rarely entering houses)... *M. spicilegus*, p. 877.
General colour above a clear rather dark greyish brown with no decided yellowish or russet tinge (eastern and east-central Europe, Sweden) ..... *M. s. spicilegus*, p. 878.
General colour above not clear greyish brown unless very pale, the back usually with decided yellowish or russet tints.
Colour of upper parts ranging from nearly clear buff to pale buffy grey (Spain) ..... *M. s. hispanicus*, p. 879.
Colour of upper parts brownish grey, usually with a decided russet tinge (Portugal) ... *M. s. lusitanicus*, p. 882.

MUS MUSCULUS Linnæus.

(Synonymy under subspecies.)

Geographical distribution.—At present almost cosmopolitan; everywhere characteristically associated with human dwellings, though not infrequently found at a distance from houses.

Diagnosis.—Size medium (head and body about 75 to 100 mm., hind foot, 17 to 19·4 mm., condylobasal length of skull, 19·8 to 22·4 mm.); tail about as long as head and body, often longer, rarely much shorter; hind foot narrow and slender, its greatest width across base of toes about 3 to 3·5 mm.; colour of underparts usually greyish buff, rarely forming any decided contrast with the dusky brown or buffy brown of sides and back.

External characters.—General form rather slender, with no special peculiarities. Ear moderately large, extending a little beyond eye when laid forward, its outline broadly oval; a well developed but low ridge on inner surface behind meatus; entire surface of ear finely pubescent except internally toward base. Fore foot with thumb reduced to a small tubercle with very rudimentary appressed nail; fifth finger extending slightly beyond base of fourth; second nearly equal to third and fourth which are sub-equal and longest; tubercles small, occupying distinctly less than half the surface of palm; the three anterior are nearly circular in outline and about as large as thumb, that lying at base of fifth finger with small but distinct supplemental outer tubercle, the two posterior are decidedly larger and somewhat elongated; surface of palm between tubercles irregularly tuberculo-reticulate; scales on under surface of fingers tending to be divided at middle. Hind foot relatively shorter and more robust than in *Apodemus sylvaticus*, its greatest width at base of toes about 3 to 3·5 mm.; the three median toes sub-equal, the inner usually not so long as the others; first digit extending about to base of second, fifth extending a little beyond base of fourth; sole naked except at sides of heel, its surface smooth

posteriorly, finely tuberculate anteriorly; plantar tubercles small, widely spaced, without noticeable contrasts in size or form, the two anterior slightly the largest, the postero-external slightly the smallest, their outlines ovate or nearly circular; a small but distinct supplemental tubercle at outer margin of tubercles lying at base of first and fifth toes. Claws simple, curved, those on hind feet slightly the larger. Tail about as long as head and body, sometimes a little longer, rarely much shorter unless injured, its diameter at base about 3 mm., its tip not so slender as in *Apodemus sylvaticus;* annulations well defined but narrow, about twenty-two to the centimeter at middle, the boundaries of the individual scales obscurely marked; hairs rather numerous but not concealing annulations, and not forming pencil, their length equal to about width of two and a half rings. Fur soft throughout, the grooved hairs so slender as not to suggest bristles in texture. Mammæ: $p\ 3-3$; $i\ 2-2=10$.

Colour.– Upper parts a light, dull wood-brown, irregularly darkened with slaty and blackish along back, faintly more buffy on sides, the general effect not far from the broccoli-brown of Ridgway, but usually with a peculiar dusky cast; underparts essentially like sides or a little more yellowish, the line of demarcation absent or very obscure; bases of hairs everywhere slate-grey, this colour usually appearing at surface on chin and throat, where it produces a smoke-grey or drab-grey effect; ear dull brownish, the outer side of anterior border usually darker; feet drab or dusky, not contrasting with back; tail dull brownish throughout, occasionally lighter below than above.

Skull. As compared with that of small European *Muridæ* of other genera, *Micromys* excepted, the skull of *Mus musculus* is immediately recognizable by its small size. Its general form is characterized by a peculiar flatness not found in any of the others. Dorsal profile slightly convex throughout, the nasals sloping forward at an angle which causes an evident break in the general curve; occiput low, somewhat obliquely truncate, so that the entire supraoccipital between lambda and foramen magnum is visible when skull is viewed from above; ventral profile faintly concave; contrast between depth of brain-case and rostral depth noticeably less than in *Apodemus sylvaticus.* Brain-case short-oval in outline when viewed from above, with a slight though evident tendency toward squaring behind and in front. Interparietal rather large, its area nearly equal to that of one parietal, its general form ligulate, the anterior border projecting forward at middle, the lateral extremities almost squarely

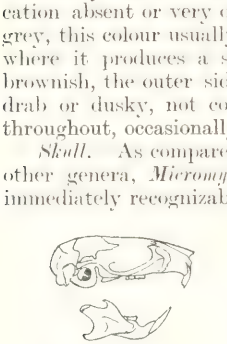


FIG. 177.
Mus musculus. Nat. size.

truncate; lambdoid suture passing along anterior border of interparietal so that the bone lies entirely within occipital;* sides of brain-case abruptly rounded off or faintly angular, never beaded. Occiput broad and low when viewed from behind, but central portion of brain-case not rising conspicuously above it; paroccipital process short and inconspicuous, barely extending to level of lower lip of foramen magnum. Floor of brain-case with no striking peculiarities; width of basioccipital along anterior border contained about $2\frac{1}{2}$ times in median length; auditory bulla moderately large, less inflated than in *Apodemus sylvaticus* but occupying about the same area on base of skull, its beak rather short and broad, but evident, the meatus with anterior portion of upper border slightly projecting. Interorbital region distinctly wider than rostrum, slightly convex laterally, the margins falling away squarely but with no trace of bead. Zygoma relatively heavy, compressed throughout but not evidently expanded, moderately bent downward and moderately spreading anteriorly, so that greatest zygomatic breadth is usually just in front of glenoid level; plate forming outer wall of anteorbital foramen well developed, its anterior border vertical, abruptly rounded above; a short but very distinct peg-like process for muscle attachment at antero-inferior angle of plate, this process nearly as well developed in half-grown young as in adults. Rostrum slightly deeper than broad, with no special peculiarities of form; nasals truncate or bluntly pointed posteriorly, extending to or slightly beyond lachrymal level, and usually a little exceeded by nasal branches of premaxillaries. Incisive foramina very long (nearly equal to diastema), extending from about 1·5 mm. behind incisors to level of middle of crown of m^1; their greatest width is at region of maxillo-premaxillary suture; posteriorly they narrow to an almost acute termination, a peculiarity of form highly characteristic of this group as compared with other European *Muridæ*. Palate extending slightly behind level of m^3, its length behind incisive foramina less than width including tooth-rows. Mesopterygoid space moderately long, wider posteriorly than anteriorly, squarely truncate in front, the pterygoids and hamulars straight, the latter barely in contact with bullæ. Mandible rather short and deep as compared with that of *Apodemus sylvaticus*, the coronoid process well developed, strongly curved backward, its tip rising slightly above level of condyle.

Teeth.—Upper incisors much compressed, the outer and inner borders nearly parallel through anterior half of their extent, the transverse diameter contained about $2\frac{1}{2}$ times in antero-posterior diameter. Enamel unusually thick, scarcely extending backward on inner side of tooth, but folding notice-

* In *Apodemus agrarius*, which has a similarly ligulate interparietal, the suture passes along posterior border so that the small bone lies within the parietals (fig. 168, p. 837).

ably backward on outer side. Main axis of shafts diverging posteriorly, the angle at which they are set such that a conspicuous sub-apical notch is formed on outer side of cutting edge of tooth immediately behind margin of enamel. First upper molar three-rooted, the anterior root largest, projecting conspicuously forward beyond base of crown, separated from more posterior roots by an appreciable space; crown decidedly longer than that of m^2 and m^3 together, its area nearly $1\frac{1}{2}$ times as great; anterior border of crown smooth or with a slight angle representing cingulum; first lamina with crescentic form much distorted by the displacement backward of $t1$ to a position essentially in line with $t5$ and $t6$; $t3$ well developed, nearly equal to $t4$ or $t6$, but not so large as $t1$, its separation from $t2$ marked by an evident re-entrant extending almost to base of crown; $t1$ separated from $t2$ by a broad, flattened or slightly concave area which imparts to the antero-internal border of the crown a characteristic obliquely-truncate appearance; second lamina more regularly crescentic than first, but with evident traces of the same distortion; third lamina represented by well developed $t8$ and $t9$ essentially similar to $t5$ and $t6$, but with no trace of $t7$ unless a short enamel ridge connecting $t4$ and $t8$ be interpreted as representing a trace of this tubercle. Second upper molar with first lamina represented by a well developed, sub-terete $t1$ about as large as the outer tubercles of m^1; second lamina with $t4$ slightly larger than $t6$ and connected posteriorly with $t8$ as in the preceding tooth; third lamina about as in m^1, but $t9$ reduced, decidedly smaller than $t6$, though marked off from $t8$ by an evident re-entrant angle. Third upper molar relatively smaller than in any of the other European *Muridæ*, its area scarcely greater than that of terminal heel of m^2. In form the crown is sub-circular with a small, often indistinct tubercular antero-internal supplement representing $t1$. Anterior lower molar with crown about as long as those of the two succeeding teeth together, its area about equal to them; first lamina reduced to a single large tubercle forming the entire anterior border of the tooth and situated slightly internal to the median line of the crown; internally it is separated from second lamina by a deep re-entrant depression, but externally it is connected with outer tubercle of second lamina by a high, sometimes distinctly tubercular ridge, which occasionally * forms a

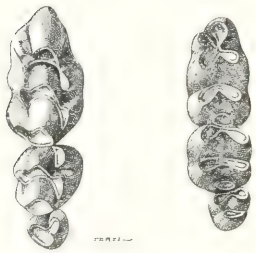


FIG. 178.

Mus musculus. Cheek-teeth. × 10. (Antero-external re-entrant angle of m_1 usually much less evident.)

* As in specimen represented in fig. 178.

true outer tubercle on first lamina ; second and third laminæ and terminal heel normal and with no trace of supplemental tubercles on outer side of crown. Second lower molar essentially like second and third laminæ of first, but with tubercles of posterior lamina distinctly smaller than those of anterior lamina, and terminal heel greatly reduced. Third lower molar with crown area equal to about one-third that of second, its anterior lamina with two tubercles smaller than those of posterior lamina of second tooth, its terminal heel relatively better developed than that of m^2.

Remarks.—Although occasionally straying to considerable distances from houses, *Mus musculus* is characteristically an urban species, and its spread from central Asia to Europe and thence throughout the world has been chiefly due to human agency. Two moderately well-marked local races occur on the continent of Europe, while two more strongly differentiated forms are confined respectively to St. Kilda Island and the Faeroes.

Mus musculus musculus Linnæus.

1758. [*Mus*] *musculus* Linnæus, Syst. Nat., I, 10th ed., p. 62 (Sweden).

1801. *M*[*us*] *m*[*usculus*] *albus* Bechstein, Gemeinn. Naturgesch. Deutschlands, I, 2d ed., p. 955 (Thüringen, Germany).

1801. *M*[*us*] *m*[*usculus*] *flavus* Bechstein, Gemeinn. Naturgesch. Deutschlands, I, 2d ed., p. 955 (Thüringen, Germany).

1801. *M*[*us*] *m*[*usculus*] *maculatus* Bechstein, Gemeinn. Naturgesch. Deutschlands, I, 2d ed., p. 955 (Thüringen, Germany).

1801. *M*[*us*] *m*[*usculus*] *niger* Bechstein, Gemeinn. Naturgesch. Deutschlands, I, 2d ed., p. 955 (Thüringen, Germany).

1827. [*Mus musculus*] *β striatus* Billberg, Synopsis Faunæ Scandinaviæ, p. 6 (Skåne, Sweden).

1827. [*Mus musculus*] *γ albicans* Billberg, Synopsis Faunæ Scandinaviæ, p. 6 (Skåne, Sweden).

1827. [*Mus musculus*] *δ niveus* Billberg, Synopsis Faunæ Scandinaviæ, p. 6 (Molle, Norway).

1837. ?*Mus brevirostris* Waterhouse, Proc. Zool. Soc., London, p. 19 (Maldonado, Uruguay).

1844. ?*Drymomys parvulus* Tschudi, Fauna Peruana, p. 178 (Central Peru).

1857. *Mus musculus* Blasius, Säugethiere Deutschlands, p. 320.

1867. [*Mus musculus*] *helvolus* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LVI, pt. I, p. 70 (Hungary).

1867. [*Mus musculus*] *varius* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LVI, pt. I, p. 70 (Europe).

1867. [*Mus musculus*] *cinereo-maculatus* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LVI, pt. I, p. 70 (Europe).

1869. *Mus poschiavinus* Fatio, Faune Vert. Suisse, I, p. 207 (Poschiavo, Grisons, Switzerland).

1872. *Mus musculus* var. *flavescens* Fischer, Zool. Garten, XIII, p. 223, July, 1872 (Berlin, Germany).

1910. *Mus musculus* and *M. musculus poschiavinus* Trouessart, Faune Mamm. d'Europe, p. 145.

Type locality.—Upsala, Sweden.

Geographical distribution.—Europe north of the Mediterranean region.

Diagnosis.—General colour dark and brownish, usually without evident yellowish tinge, the belly dusky greyish.

Measurements.—Adult male and female from Iceland: head and body, 87 and 89; tail, 95 and 92; hind foot, 18·6 and 19; ear, 17 and 16. Average and extremes of seven adults from near London, England: head and body, 78·4 (75–84); tail, 78·6 (76–86); hind foot, 17·3 (16·6–18). Adult male and female from Richmond, Surrey: head and body, 81 and 80; tail, 89 and 77; hind foot, 16·6 and 17; ear, 14·4 and 14. Adult female from Holme, Mandal, Norway: head and body, 85; tail, 89; hind foot, 17·4; ear, 14. Average and extremes of eight adults from the Harz Mountains, Germany: head and body, 96 (87–103); tail, 90·2 (84–102); hind foot, 18·4 (17·6–19·4). For cranial measurements see Table, p. 872.

Specimens examined.—One hundred and one, from the following localities:—

ICELAND: Near Reykjavik, 7 (U.S.N.M.).

SCOTLAND: North Uist, Hebrides, 1 (Edinburgh); Dunvegan, Skye, 1; Grantown-on-Spey, Elgin, 2 (Wilson); Jardine Hall, Dumfriesshire, 4 (U.S.N.M.).

ENGLAND: Oundle, Northamptonshire, 3; Broxbourne, Hertfordshire, 1; Berkhamsted, Hertfordshire, 1; Cheltenham, Gloucestershire, 1 (Wilson); London, 3 (B.M. and U.S.N.M.); Richmond, Surrey, 5 (U.S.N.M.); Wandsworth Common, Surrey, 4; Martock, Somerset, 1; Newport, Isle of Wight, 1; Ramsay, Isle of Man, 2; Ballasalla, Isle of Man, 1; St. Ouen's Bay, Jersey, 3; Alderney, 1.

IRELAND: Clare Island, Mayo, 3; Clifden, Galway, 2.

NORWAY: Graven, Hardanger, 1 (U.S.N.M.); Holme, Mandal, 6.

BELGIUM: Waremme, 2 (U.S.N.M.).

GERMANY: Harz Mountains, 19 (U.S.N.M.); Dresden, 7 (U.S.N.M.); Nuremberg, Bavaria, 1 (U.S.N.M.).

SWITZERLAND: Andermatt, Uri, 1 (U.S.N.M.); St. Gothard, Uri, 1 (U.S.N.M.); Untervatz, St. Gallen, 1; St. Gallen, 4; Poschiavo, Grisons, 4 (U.S.N.M. and Geneva); St. Cergues, Vaud, 1.

2 ♂, ♀.	Clare Island, Mayo, Ireland. (*R. H. Bunting.*)	G. Barrett-Hamilton (P).	11. 1. 2. 146–148.
♂, ♀.	Clifden, Galway. (*R. H. Bunting.*)	G. Barrett-Hamilton (P).	11. 1. 2. 149–150.
2 ♂, ♀.	Oundle, Northamptonshire, England.	Lord Lilford (P).	11. 1. 1. 166–168.
♂.	Wandsworth, Surrey.	J. Miller (C & P).	4. 2. 12. 1.
♀.	Martock, Somerset.	C. B. Horsbrugh (C & P).	11. 1. 3. 420.
♂.	Newport, Isle of Wight.	R. J. Cuninghame (C & P).	11. 1. 3. 421.
2 ♂, ♀.	St. Ouen's Bay, Jersey, Channel Islands. (*R. H. Bunting.*)	O. Thomas (P).	8. 9. 2. 7–9.

1 al.	Alderney, Channel Islands.	W. Eagle Clarke (P).	98. 9. 29. 7.
2 ♂, 3 ♀.	Holme, Mandal, Norway.	R. J. Cuninghame (C & P).	8. 8. 9. 14–18.
♂.	Untervatz, Grisons, Switzerland. (*E. H. Zollikofer.*)	O. Thomas (P).	4. 4. 5. 45.
3 ♂, ♀.	St. Gallen. (*E. H. Zollikofer.*)	O. Thomas (P).	4. 4. 5. 41–44.

Mus musculus azoricus Schinz.

1845. *M[us] azoricus* Schinz, Synops. Mamm., II, p. 161 (Azores).
1855. *Musculus mollissimus* Dehne, Allgem. deutsche Naturhist. Zeitung, Dresden, neue Folge, I, p. 443. (Monte Pollino, Basilicata, Italy).

Type locality.—Azore Islands.

Geographical distribution.—Mediterranean region; Azores.

Diagnosis.—General colour less dusky and more yellowish than in *M. musculus musculus*, the underparts buffy greyish.

Measurements.—Adult male and female from Elche, Alicante, Spain: head and body, 84 and 84; tail, 92 and 86; hind foot, 18 and 18·4; ear, 14·8 and 14. Two adult females from near Nîmes, Gard, France: head and body, 88 and 91; tail, 86 and 88; hind foot, 17·5 and 17·5; ear, 13·5 and 14·4. Average and extremes of ten adults from Sorrento, Italy: head and body, 85·5 (78–93); tail, 88·6 (82–94); hind foot, 17·7 (17–18·6). Average and extreme of ten adults from Palermo, Sicily: head and body, 85·7 (82–92); tail, 82·2 (78–85); hind foot, 17·4 (17–18·4). For cranial measurements see Table, p. 872.

Specimens examined.—One hundred and ninety, from the following localities:—

Portugal: San Miguel, Azores, 6; Estoril, 1; Cintra, 2.

Spain: Pajáres, Leon, 2; Silos, Burgos, 2; Béjar, Salamanca, 3; Dehesa de Valencia, Valencia, 1; Elche, Alicante, 2; Venta del Baul, Granada, 5; San Cristobal, Minorca, Balearic Islands, 1.

France: Biarritz, Basses-Pyrénées, 2; Ax-les-Thermes, Ariège, 1; l'Hospitalet, Ariège, 1; Porté, Pyrénées-Orientales, 1; near Nimes, Gard, 8; St. Gilles, Gard, 1; St. Paul, Basses-Alpes, 6; La Foce di Vizzavona, Corsica, 1.

Italy: Acceglio, Cuneo, 1; Calappiano, Empoli, 3; Florence, 11 (B.M. and U.S.N.M.); Rome, 2; Sorrento, 24 (U.S.N.M.); Marsala, Sicily, 1; Palermo, Sicily, 59 (B.M. and U.S.N.M.); Taormina, Sicily, 10 (U.S.N.M.); Lanusei, Sardinia, 1 (U.S.N.M.).

Greece: Corfu, 22; Patras, 6; Athens, 4 (U.S.N.M.); Argostoli, Cephalonia, 1.

5 ♂, ♀.	San Miguel, Azores. (*W. R. Ogilvie-Grant.*)	Hon. W. Rothschild (P).	3. 6. 5. 17-22.
♂.	Estoril, Portugal.	O. Thomas (C & P).	98. 2. 2. 36.
♂, ♀.	Cintra.	O. Thomas (C & P).	98. 2. 2. 28–29.
♂, ♀.	Pajáres, Leon. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 133–134.
♀.	Silos, Burgos.	G. S. Miller (C).	8. 8. 4. 109.

CRANIAL MEASUREMENTS OF *MUS MUSCULUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Breadth of brain-case.	Depth of brain-case at middle.	Nasal.	Dia-tema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
M. musculus musculus.													
Iceland: Reykjavik	155641	♂	20·0	11·0	3·8	9·8	6·0	7·6	5·2	11·8	3·4	3·0	Teeth moderately worn.
,,	155652	♂	—	12·4	4·0	10·4	6·8	—	—	13·0	3·6	3·2	,, much worn.
,,	155649	♀	20·2	11·8	3·8	10·2	6·4	7·6	5·4	12·4	3·4	3·2	,, slightly worn.
England: London	152819	♂	20·2	10·6	3·8	10·0	6·8	7·6	5·4	11·4	3·4	3·0	,, ,,
,,	152820	♂	20·6	11·0	3·6	10·0	6·4	7·8	5·4	11·6	3·6	3·0	,, ,,
Richmond, Surrey	152817	♂	20·4	11·0	3·8	9·8	6·8	8·2	5·6	11·8	3·6	3·0	,, ,,
,, ,,	153508	♂	20·2	11·2	3·6	10·0	6·8	8·0	5·6	11·6	3·6	3·0	,, ,,
,, ,,	152816	♀	20·0	11·0	3·8	9·8	6·6	—	5·6	11·4	3·6	3·2	,, ,,
Norway: Graven, Hardanger	84693	♀	20·2	11·2	3·8	9·8	6·4	7·4	5·4	11·8	3·4	3·0	,, much worn.
Belgium: Waremme, Liége	85998	♂	20·2	11·0	3·6	10·2	7·0	7·8	5·4	11·8	3·4	3·0	,, moderately worn.
Germany: Hausbruck, Hanover	112861	♀	20·8	11·2	3·8	10·0	6·6	8·0	5·8	12·2	3·6	3·2	,, ,,
,, ,,	112862	♀	21·0	12·0	3·8	10·0	6·8	8·0	6·0	12·2	3·4	3·0	,, ,,
Schierke, Hartz Mts.	112853	♀	21·4	11·8	3·8	10·4	6·6	8·0	5·6	12·2	3·6	3·2	,, ,,
,, ,,	112857	♀	20·2	11·2	3·8	10·0	6·4	7·8	5·4	11·8	3·6	3·2	,, ,,
,, ,,	112858	♀	21·6	11·6	3·8	10·4	6·8	8·2	6·0	12·2	3·6	3·2	,, ,,
Switzerland: St. Gallen	4. 5. 4. 41	♂	21·2	11·2	3·8	10·2	6·8	7·8	5·6	12·2	3·6	3·2	,, ,,
,,	4. 5. 4. 43	♂	22·0	12·0	3·8	10·0	6·4	8·2	6·0	12·8	3·6	3·2	,, ,,
,,	4. 5. 4. 45	♂	21·8	11·6	3·8	10·0	6·4	8·2	6·0	12·8	3·6	3·2	,, ,,
,,	4. 5. 4. 44	♀	22·0	12·0	3·8	10·2	6·8	8·2	6·2	12·6	3·6	3·2	,, ,,
Poschiavo, Grisons	Geneva		20·8	12·4±	4·0	10·0	—	8·8	5·6	12·0	3·6	3·0	,, ,,
M. musculus azoricus.													
Italy: Florence	103331	♂	20·6	11·0	3·6	10·0	6·6	8·0	5·4	12·2	3·6	3·2	,, ,,
,,	103327	♀	19·8	10·6	3·6	9·6	6·2	8·0	5·2	11·4	3·6	3·0	,, ,,
,,	103328	♀	20·4	11·4	3·6	9·8	6·8	8·2	5·6	12·2	3·6	3·0	,, ,,

Italy: Sorrento	103039	♂	21·8	11·8	3·6	10·2	6·6	8·2	6·0	13·0	3·4	3·0	Teeth moderately worn.	
,,	103043	♂	20·6	11·2	3·6	10·0	6·2	8·0	5·4	11·8	3·4	3·0	,,	,,
,,	103053	♂	20·2	11·0	3·8	9·6	6·2	7·8	5·4	11·8	3·4	2·8	,,	,,
,,	103036	♀	20·2	11·2	3·6	10·0	6·4	7·8	5·2	12·0	3·4	3·0	,,	,,
,,	103037	♀	21·6	11·8	3·8	10·4	6·4	8·2	5·0	12·6	3·2	3·0	,,	,,
,,	103038	♀	22·4	--	3·8	—	6·6	8·8	6·0	13·6	3·6±	—	,,	much worn.
,,	103040	♀	19·8	11·0	3·6	9·6	6·4	7·6	5·0	11·8	3·6	3·0	,,	slightly worn.
,,	103044	♀	20·2	11·2	3 4	10·0	6·2	7·8	5·2	12·4	3·6	3·0	,,	moderately worn.
,,	103046	♀	19·8	10·8	3·6	9·4	6·2	7·6	5·0	11·4	3·6	3·0	,,	,,
,,	103047	♀	21·2	11·2	3·6	9·8	6·6	8·2	5·6	12·2	3·8	3·2	,,	,,
,,	103049	♀	19·6	10·8	3·6	9·6	6·2	8·0	5·0	11·6	3·6	3·0	,,	,,
,,	103052	♀	20·0	11·4	3·8	10·0	6·0	7·8	5·0	11·6	3·8	3·2	,,	,,
Sicily: Taormina	122517	♂	20·0	10·8	3·6	9·8	6·8	8·0	5·6	11·4	3·4	3·0	,,	slightly worn.
Palermo	103201	♂	20·0	10·6	3·6	9·6	6·2	8·0	5·2	11·0	3·4	3·0	,,	moderately worn.
,,	103213	♂	21·0	11·2	3·8	9·6	6·6	8·2	5·4	11·8	3·6	3·0	,,	,,
,,	103235	♂	20·0	10·8	3·6	9·4	6·2	7·8	5·0	11·4	3·6	3·0	,,	slightly worn.
,,	103238	♂	20·0	10·8	3·6	9·6	6·6	7·8	5·4	11·6	3·6	3·0	,,	,,
,,	103193	♀	19·8	10·8	3·6	9·6	6·0	7·4	5·4	11·2	3·6	3·0	,,	,,
,,	103197	♀	20·6	11·4	3·8	10·0	6·8	8·2	5·4	12·0	3·8	3·2	,,	,,
,,	103198	♀	20·4	11·2	3·6	9·8	6·8	7·8	5·6	12·2	3·8	3·2	,,	moderately worn.
,,	103211	♀	21·2	11·8	3·6	9·8	6·6	8·2	5·6	12·2	3·6	3·0	,,	,,
,,	103218	♀	20·4	11·0	3·8	9·8	6·4	8·0	5·6	12·0	3·6	3·0	,,	slightly worn.
,,	103219	♀	20·4	11 0	3·8	9·8	6·4	8·0	5·2	11·6	3·6	3·0	,,	,,
,,	103220	♀	20·8	10·8	3·8	9·6	6·6	7·8	5·2	12·0	3·8	3·0	,,	moderately worn.
,,	103222	♀	20·2	11·0	3·6	9·2	6·2	7·8	5·6	11·2	3·6	3·0	,,	,,
,,	103223	♀	20·2	11·0	3·4	9·2	6·2	8·0	5·0	11·4	3·8	3·0	,,	,,
,,	103234	♀	20·6	11·0	3·6	9·4	6·4	8·0	5·2	11·6	3·8	3·0	,,	,,
,,	103240	♀	20·2	10·8	3·8	9·8	6·8	8·0	5·2	11·2	3·6	3·0	,,	,,
,,	103245	♀	20·2	11·2	3·6	10·0	6·8	7·8	5·2	11·8	3·6	3·0	,,	,,
,,	103246	♀	20·8	11·2	3·6	9·8	6·6	8·2	5·4	12·8	3 6	3·0	,,	,,
Corsica: Vizzavona	93. 9. 15. 9	♂	22·2	12·6	3·6	10·0	6·6	8·8	6·4	13·4	4·0	3·2	,,	,,
Spain: San Cristobal, Minorca	0. 7. 1. 58	♂	21·4	11·6	3·6	10·2	7·0	8·2	5·8	12·2	3·6	3·0	,,	,,
Venta del Baul, Granada	8. 8. 4. 112	♀	22·0	—	3·6	—	—	8·2	5·6	12·8	3·8	3·2	,,	much worn.
Greece: Corfu	152804	♂	21·0	11·4	3·6	10·0	6·8	8·2	5·2	11·8	3·8	3·0	,,	moderately worn.
Athens	114119	♀	20·2	10·4	3·6	9·6	6·2	8·0	5·6	11·6	3·6	3·0	,,	,,

♂, 2 ♀.	Béjar, Salamanca. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 136–138.
♂.	Dehesa de Valencia. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 135.
♂, ♀.	Elche, Alicante.	G. S. Miller (C).	8. 8. 4. 107–108.
♂, 2 ♀.	Venta del Baul, Granada.	G. S. Miller (C).	8. 8. 4. 110–112.
♀.	Venta del Baul, Granada. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 130.
♂.	San Cristobal, Minorca, Balearic Islands.	O. Thomas and R. I. Pocock (C & P).	0. 7. 1. 58.
♀.	St. Gilles, Gard, France.	G. S. Miller (C).	8. 8. 4. 222.
4 ♀.	Nimes, Gard. (*C. Mottaz.*)	O. Thomas (P).	8. 8. 10. 93–96.
♂, ♀.	St. Paul, Basses-Alpes, 1470 m. (*C. Mottaz.*)	O. Thomas (P).	8. 8. 10. 97–98.
♂, ♀.	Rome. (*Coli.*)	G. Barrett-Hamilton (P).	11. 1. 2. 38–39.
♂.	Marsala, Sicily. (*A. Robert.*)	O. Thomas (P).	6. 8. 4. 44.
3 ♂, ♀.	Palermo.	J. I. S. Whitaker (P).	98. 10. 6. 12–15.
♀.	La Foce de Vizzavona, Corsica.	Col. J. W. Yerbury (C & P).	93. 9. 15. 9.
2 ♂, 4 ♀.	Corfu, Greece. (*C. Mottaz.*)	O. Thomas (P).	8. 10. 1. 43–48.
3 ♂, 2 ♀.	Corfu, Greece.	C. Mottaz (C).	8. 11. 3. 12–16.
2 ♂, ♀.	Patras, Greece. (*C. Mottaz.*)	Hon. N. C. Rothschild (P).	8. 10. 2. 44–46.
♂.	Argostoli, Cephalonia.	C. Mottaz (C).	8. 11. 3. 17.

MUS MURALIS Barrett-Hamilton.

1899. *Mus muralis* Barrett-Hamilton, Proc. Zool. Soc., London, p. 81. Type in British Museum.

1910. *Mus musculus muralis* Trouessart, Faune Mamm. d'Europe, p. 146.

Type locality. Island of St. Kilda, Scotland.

Geographical distribution.—Island of St. Kilda.

Diagnosis.—Similar to *Mus musculus*, but feet and tail less slender (width of hind foot at base of outer toes about 4 mm.); skull with mesopterygoid fossa coming to a sharp point anteriorly, the pterygoids nowhere parallel.

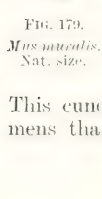


Fig. 179.
Mus muralis.
Nat. size.

External characters.—Except for the less slender tail and more robust feet the external characters do not differ appreciably from those of *Mus musculus.*

Colour.—The colour is essentially as in *Mus musculus*, though the underparts appear to be more frequently a well-defined buffy white.

Skull and teeth.—Apart from the peculiarities of the palate the skull agrees with that of *Mus musculus.* Mesopterygoid space conspicuously narrower anteriorly than posteriorly, its lateral borders nowhere approximately parallel, its width in front only one-third to one-fourth that between tips of hamulars. This cuneate form, though less accentuated in immature specimens than in adults, is constantly different from that charac-

teristic of the large series of European specimens of *Mus musculus* examined. Teeth as in *Mus musculus*.

Measurements. — External measurements of type (adult female): head and body, 90; tail, 85; hind foot, 17·4; ear, 14. Adult male and female from the type locality: head and body, 84 and 89; tail, 89 and 87; hind foot, 18·8 and 18; ear, 14 and 14. For cranial measurements see Table, p. 876.

Specimens examined.—Fifteen, all from St. Kilda (B.M. and Edinburgh).

♀.	St. Kilda, Scotland. (*H. Evans.*)	G. Barrett-Hamilton (P). (*Type* of species.)	8. 7. 16. 1.
♂, ♀ al.	St. Kilda.	J. E. Harting (P).	94. 7. 16. 2–3.
1 al.	St. Kilda.	Kelvingrove Museum, Glasgow (P).	96. 0. 6. 1.
2 ♂, 3 ♀.	St. Kilda.	W. Eagle Clarke (C & P).	11. 1. 24. 7–11.

MUS FÆROENSIS Clarke.

1904. *Mus musculus færoensis* Clarke, Proc. Roy. Phys. Soc. Edinburgh, XVI, pt. II, p. 163. Type in Royal Scottish Museum.
1910. *Mus musculus færoensis* Trouessart, Faune Mamm. d'Europe, p. 146.

Type locality.—Nolsoe, Faeroe Islands.

Geographical distribution.—Faeroe Islands.

Diagnosis. — Decidedly larger than *Mus musculus* and *M. muralis* (hind foot, 19 to 20 mm., condylobasal length of skull, 23 to 23·4 mm.); hind foot very robust, its width at base of outer toes about 5 mm.; tail noticeably thickened, its diameter near base about 4 mm. as opposed to 3·6 mm. in *M. muralis* and about 3 mm. in *M. musculus*.

External characters.—Except as already pointed out the external characters agree with those of *Mus musculus*.

Colour.—The few specimens examined indicate that the colour does not differ essentially from that of *Mus musculus*.

Skull and teeth.—The skull resembles that of *Mus musculus* except for its larger size, relatively more robust rostrum and apparently more depressed brain-case, though the material is insufficient to show whether this last character is constant. In the three skulls examined from Nolsoe the palate is as usual in *Mus musculus*, the interpterygoid space broadly rounded or truncate anteriorly, and the pterygoids, though imperfect, evidently not far from parallel. The skull from Myggenæs, however, as pointed out by Dr. Winge in the letter published in the original description of the species, has the pterygoid region exactly as in *Mus muralis*. This skull (No. 1229 Copenhagen Museum) is abnormal, the rostrum having been bent to the left, apparently by some injury when the animal was young. The teeth are slightly larger than those of *Mus musculus*, but I can detect no peculiarities of form.

Measurements.— Type (adult female): hind foot (dry), 20. Adult male from the type locality: head and body, 85; tail, 97;

CRANIAL MEASUREMENTS OF *MUS MURALIS* AND *M. FÆROENSIS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Breadth of brain-case.	Depth of brain-case at middle.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
M. muralis.													
Scotland: St. Kilda Island	94. 7. 16. 1	♂	22·2	12·0	3·8	10·2	7·0	8·8	6·0	13·0	3·8	3·2	Teeth moderately worn.
,,	94. 7. 16. 2	♂	21·6	12·0	3·8	10·0	6·8	8·2	5·8	12·8	3·8	3·2	,, ,,
,,	8. 7. 16. 1*	♀	22·0	12·4	3·8	10·2	7·2	8·6	6·0	13·2	3·6	3·0	,, ,,
,,	1905. 120. 3. 3†	♂	21·6	12·6	3·6	10·2	7·2	8·2	5·8	13·0	3·6	3·0	,, ,,
,,	1905. 120. 3. 4	♂	22·0	12·0	3·6	10·0	7·0	—	5·6	13·0	3·8	3·2	,, ,,
,,	1905. 120. 4. 2	♀	21·0	11·8	3·4	10·0	7·0	—	5·6	12·2	3·4	3·0	,, slightly worn.
,,	1905. 120. 4. 5	♀	21·6	12·0	3·6	10·0	6·8	8·2	5·6	12·6	3·8	3·2	,, moderately worn.
,,	1905. 120. 4. 12	♀	22·2	12·2	3·8	10·2	7·0	8·6	6·2	13·8	3·8	3·2	,, ,,
,,	1905. 120. 4. 13	♀	21·6±	11·2	3·8	9·8	—	8·0	5·8	12·4	3·8	3·2	,, ,,
M. færoensis.													
Faeroe Islands: Nolsoe	1905. 119	♂	23·4	12·6±	3·8	10·6	6·4	8±	6·8	14·0	3·6	3·2	,, ,,
,,	1366 Copenhagen	♂	23±	12·4	3·8	—	—	8·8	6·4	14·0	4·0	3·2	,, ,,
,,	1366 Copenhagen		23·2	12·6±	3·6	—	—	9·0	6·6	13·6	4·0	3·2	,, ,,
Myggenæs	1229 Copenhagen	♂	23·0	12·8	3·8	10·6	7·0	8±	—	14·0	3·8	3·2	,, ,,

* Type. † Royal Scottish Museum.

hind foot, 20; ear, 13. Adult female from the type locality: hind foot (in alcohol), 19·8. For cranial measurements see Table opposite.

Specimens examined.—Six, three from Nolsoe (Edinburgh and Copenhagen), and three from Myggenæs (Copenhagen).

Remarks.—The Faeroe house mouse differs so conspicuously from all other known members of the group, that however recent the animal's origin may have been there seems no doubt that the form is a distinct species. The enlarged extremities may be, as suggested by Dr. Winge, the result of changed habits due to a climbing life among the cliffs of the islands; but in view of the fact that a similar tendency is shown by two of the resident birds of the Faeroes, it seems more probable that the characters of all these local forms has been determined by some more general factor of climate or food.

The only species with which *Mus færoensis* is likely to be confused is *Mus muralis* of St. Kilda. But the size of the Faeroe mouse is noticeably greater, and the peculiar thickening of the feet is carried to a more noticeable extreme. The general colour of the body is darker than in *Mus muralis*, essentially as in ordinary specimens of the house mouse, and the underparts and feet show no tendency to become whitish.

MUS SPICILEGUS Petényi.

(Synonymy under subspecies.)

Geographical distribution.—Eastern and southern Europe, west to Portugal, Hungary and Sweden.

Diagnosis.—Size less than in *Mus musculus*, the head and body rarely attaining a length of 90 mm., the hind foot in adults ranging about from 15·4 to 18 mm., condylobasal length of skull, 19 to 21·4 mm.; tail noticeably shorter than head and body (exceptions very rare); colour of underparts usually whitish in abrupt contrast with that of sides; upper incisor with sub-apical notch less developed than in *Mus musculus*.

Colour.—For detailed descriptions of the colour see accounts of subspecies. In the yellower races the colour is strikingly different from that of *Mus musculus*. In the browner forms the general aspect is much like that of the house mouse, but the back is a clearer less dusky brown.

Remarks.—*Mus spicilegus* is a strictly agrarian animal, found in fields, scrub, and open, dry forest, and never inhabiting towns. It is undoubtedly indigenous to the Mediterranean region. Related forms occur in the corresponding life zone of north Africa and of Asia Minor and central Asia. Among the European representatives of the species three races may be distinguished, one of which ranges somewhat further north than the others.

Mus spicilegus spicilegus Petényi.

1882. *Mus spicilegus* Petényi, Természetrajzi Füzetek, Budapest, v, p. 114.
1882. *Mus acervator* Petényi, Természetrajzi Füzetek, Budapest, v, p. 114 (alternative name).
1882. *Mus acervifex* Petényi, Természetrajzi Füzetek, Budapest, v, p. 114 (alternative name).
1882. *Mus canicularius* Petényi, Természetrajzi Füzetek, Budapest, v, p. 114 (alternative name).
1882. *Mus caniculator* Petényi, Természetrajzi Füzetek, Budapest, v, p. 114 (alternative name).
1896. *Mus musculus flavescens* Barrett-Hamilton, Zoologist, 3d. ser., xx, p. 179, May 1896 (not *Mus musculus* var. *flavescens* Fischer, 1872).
1910. *Mus spicilegus* Trouessart, Faune Mamm. d'Europe, p. 148.

Type locality.—Hungary.

Geographical distribution.—East central Europe from the northern portion of the Balkan Peninsula to the shores of the Baltic; westward into Sweden.

Diagnosis.—General colour of upper parts a clear greyish brown without decided yellowish or russet suffusion.

Colour.—Upper parts a light wood-brown, becoming somewhat buffy on sides, the entire median region from nose to base of tail rather conspicuously though finely "lined" with black, this "lining" sometimes producing an evident dark median dorsal area, and always becoming inconspicuous on sides and disappearing entirely on narrow area bordering lighter colour of underparts. Basal portion of hairs slate-grey. Underparts rather sharply defined buffy white or pale cream-buff, the slate-grey bases of the hairs producing a slight greyish cast. Feet and under surface of tail essentially concolor with belly; upper surface of tail brownish without sharp line of demarcation. Ears sprinkled with brownish hairs externally, with buffy internally, neither surface with any decided colour.

Measurements.—Average of seven adults from Upsala, Sweden: head and body, 86·2 (82–96); tail, 67·8 (60–77); hind foot, 17·1 (15·4–17·4). Average and extremes of seven adults from near Königsberg, Germany: head and body, 81·9 (73–90); tail, 67·8 (60–75); hind foot, 16·8 (16·4–17·4). Adult female from Hatszeg, Hunyad, Hungary: head and body, 81; tail, 62; hind foot, 17; ear, 12. Adult male from Gageni, Roumania: head and body, 75; tail, 60; hind foot, 16; ear, 12. Average and extremes of five adults from Patrily, Roumania: head and body, 77·5 (72–83); tail, 6·21 (59·5–70); hind foot, 16·2 (16–16·5); ear, 12 (11·5–13·5). For cranial measurements see Table, p. 880.

Specimens examined.—Fifty-seven, from the following localities:—
Sweden: Upsala, 10 (U.S.N.M.); Stockholm, 2 (U.S.N.M.).
Germany: Baltic coast, west of Königsberg, 17 (U.N.N.M.).
Austria-Hungary: Csallóköz-Somorja, Pressburg, 5; Hatszeg, Hunyad, 2; Pester Comitat, 2.

ROUMANIA: Gageni, Prahova, 1; Patrily, 7.
MONTENEGRO: Various localities, 5.
ALBANIA: Various localities, 6.

5.	Csallóköz-Somorja, Pressburg, Hungary.	Budapest Museum (E).	94. 3. 1. 48–52.
2 ♀.	Hatszeg, Hunyad, Transylvania.	C. G. Danford (C).	3. 2. 2. 33–34.
♂, ♀.	Pester Comitat.	Budapest Museum (P).	94. 7. 26. 1–2.
♂.	Gageni, Prahova, Roumania. (*W. Dodson.*)	Lord Lilford (P).	4. 4. 6. 41.
7 ♂.	Patrily, Roumania. (*W. Dodson.*)	Lord Lilford (P).	4. 4. 6. 42–48.
2 ♂, 3 ♀.	Montenegro. (*L. Führer.*)	O. Thomas (P).	5. 8. 4. 18–22.
3 ♂, 3 ♀.	North Albania. (*L. Führer.*)	O. Thomas (P).	5. 8. 4. 38–43.

MUS SPICILEGUS HISPANICUS Miller.

1909. *Mus spicilegus hispanicus* Miller, Ann. and Mag. Nat. Hist., 8th ser., III, p. 421, May, 1909.
1910. *Mus spicilegus hispanicus* Trouessart, Faune Mamm. d'Europe, p. 148.

Type locality.—Silos, Province of Burgos, Spain.

Geographical distribution.—Central and southern Spain.

Diagnosis.—General colour of upper parts buffy or pale buffy grey.

Colour.—Back and sides ranging from buff to a pale buffy grey lighter and less yellow than the cream-buff of Ridgway, the median dorsal region faintly "lined" with black, the sides gradually becoming clear buff or buffy grey, this colour continuing forward over cheeks and above eye to muzzle; basal portion of hairs slate-grey. Underparts sharply defined buffy white, slightly clouded by slate-grey undercolour. Feet and tail like belly, the tail with a narrow dusky dorsal area extending to tip. Ear thinly clothed, the colour buffy or greyish in harmony with surrounding parts.

Measurements.—Type (adult female): head and body, 79; tail, 50; hind foot, 14·4; ear, 13·6. Average and extremes of four adults from the type locality: head and body, 76·7 (75–79); tail, 53·7 (50–58); hind foot, 15·4 (14·4–16); ear from meatus, 12·8 (12–13·6). Average and extremes of ten adults from Elche, Alicante, Spain: head and body, 81·4 (76–91); tail, 62·1 (59–72); hind foot, 16·5 (16–17); ear, 13·6 (13–14). Average and extremes of seven adults from San Cristobal, Minorca, Balearic Islands: head and body, 77·2 (75–80); tail, 63·2 (59–66); hind foot, 16·1 (15·6–16·8); ear, 12·5 (12–13). For cranial measurements see Table, p. 880.

Specimens examined.—Eighty-five, from the following localities:—
SPAIN: Venta del Baul, Granada, 7: Elche, Alicante, 24; Alcoy, Alicante, 21; Silos, Burgos, 12; Castrillo de la Reina, Burgos, 3; Pajáres,

CRANIAL MEASUREMENTS OF *MUS SPICILEGUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Breadth of brain-case.	Depth of brain-case at middle.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
M. spicilegus spicilegus.													
Sweden: Upsala . .	85060	♂	20·0	11·2	3·4	9·6	6·6	7·2	5·4	11·4	3·4	3·0	Teeth moderately worn.
,, . .	85063	♂	21·4	11·8	3·8	10·4	7·2	7·8	6·0	12·4	3·8	3·2	,, much worn.
,, . .	85062	♀	20·6	11·4	3·8	10·2	6·8	7·4	5·4	11·8	3·6	3·0	,, moderately worn.
Stockholm .	37658	♂	21·0	11·1	3·6	9·8	6·4	8·0	6·0	12·6	3·6	3·2	,, ,,
Germany: Königsberg .	112279	♂	21·2	—	3·6	—	7·0	8·4	5·8	12·2	3·4	3·0	,, much worn.
,, .	112287	♂	19·4	10·4	3·4	9·8	6·2	7·8	5·4	11·2	3·4	3·0	,, moderately worn.
,, .	112276	♀	20·4	11·0	3·4	9·4	6·4	7·8	6·0	11·0	3·4	3·0	,, much worn.
,, .	112283	♀	19·8	10·6	3·4	9·6	6·2	7·6	5·2	11·4	3·4	3·0	,, ,,
M. spicilegus hispanicus.													
Spain: Majorca, Balearic Islands . .	0. 7. 1. 18	♂	19·0	10·0	3·4	9·2	6·2	7·6	5·6	11·0	3·2	2·8	,, moderately worn.
,, ,,	0. 7. 1. 21	♂	20·0	10·8	3·4	9·2	6·6	8·0	5·8	11·8	3·4	3·0	,, ,,
,, ,,	0. 7. 1. 23	♀	—	11·0	3·4	9·4	—	8·0	5·8	12·0	3·8	3·0	,, much worn.
,, ,,	0. 7. 1. 22	♀	19·8	10·8	3·4	9·6	6·2	8·0	5·6	11·8	3·6	3·0	,, moderately worn.

Spain: Minorca, Balearic Island	0. 7. 1. 59	♂	20·4	11·0	3·4	9·6	6·6	8·0	6·2	12·4	3·4	2·8	Teeth much worn.	
Silos, Burgos	8. 8. 4. 98		19·2	11·0	3·4	9·4	6·6	7·6	5·2	11·2	3·6	3·2	,,	slightly worn.
,, ,,	8. 8. 4. 100		19·8	11·2	3·4	9·8	6·6	7·8	5·4	11·2	3·4	3·2	,,	,,
,, ,,	8. 8. 4. 101*	♀	19·4	11·0	3·4	9·6	6·6	7·6	5·2	11·4	3·4	3·2	,,	,,
Elche, Alicante	152827	♂	19·8	10·8	3·6	9·6	6·2	8·0	5·6	11·8	3·6	3·0	,,	moderately worn.
,, ,,	172259	♂	20·2	11·4	3·4	9·8	6·6	7·6	5·6	12·4	3·8	3·2	,,	,,
,, ,,	172263	♂	20·2	11·0	3·4	9·6	6·4	8·0	5·6	11·8	3·6	3·0	,,	,,
,, ,,	8. 2. 9. 149	♂	19·0	10·4	3·2	9·2	6·6	8·0	5·6	11·2	3·2	3·0	,,	slightly worn.
,, ,,	8. 2. 9. 152	♂	19·0	10·2	3·4	9·2	6·2	7·4	5·4	11·2	3·2	3·0	,,	moderately worn.
,, ,,	8. 2. 9. 154	♂	21·4	11·6	3·6	10·0	6·8	8·0	6·2	12·8	3·4	3·2	,,	much worn.
,, ,,	8. 2. 9. 156	♀	19·2	10·4	3·4	9·0	6·4	7·4	5·4	11·4	3·2	3·0	,,	slightly worn.
,, ,,	8. 2. 9. 159	♂	19·4	10·6	3·6	9·6	6·2	7·6	5·6	11·4	3·2	3·0	,,	moderately worn.
,, ,,	172258	♀	21·0	11·8	3·6	9·8	6·2	8·2	6·0	12·4	3·6	3·0	,,	much worn.
,, ,,	172262	♀	20·0	11·0	3·2	9·4	6·4	8·0	5·8	11·8	3·2	2·8	,,	moderately worn.
Alcoy, Alicante	8. 2. 9. 139	♂	20·2	11·2	3·4	9·6	6·4	8·2	5·6	11·6	3·4	3·0	,,	,,
,, ,,	8. 2. 9. 143	♂	20·2	11·2	3·6	9·8	6·6	7·8	5·6	12·0	3·6	3·0	,,	,,
,, ,,	8. 2. 9. 148	♀	20·0	11·0	3·4	9·4	6·0	7·8	5·4	12·0	3·2	2·8	,,	,,
,, ,,	152837	♀	19·8	11·0	3·6	9·4	6·2	7·4	5·4	11·4	3·6	3·0	,,	slightly worn.
Venta del Baul, Granada	8. 8. 4. 104	♂	19·8	11·0	3·4	9·2	6·2	7·8	5·4	11·6	3·6	3·0	,,	moderately worn.
,, ,,	172256	♂	19·2	10·8	3·4	9·6	6·6	7·4	5·2	11·2	3·8	3·0	,,	,,
,, ,,	8. 8. 4. 106	♀	21·0	11·6	3·6	9·8	6·4	8·0	5·8	12·2	3·6	3·0	,,	,,
M. spicilegus lusitanicus.														
Portugal: Cintra	98. 2. 2. 30*	♂	19·8	10·6	3·4	9·6	6·4	7·6	5·6	11·6	3·6	3·0	,,	,,
,,	—	♂	—	10·6	3·4	9·6	—	7·8	5·6	11·4	3·6	3·0	,,	,,
,,	—	♀	20·2	11·0	3·6	9·6	6·2	7·8	5·8	12·2	3·8	3·0		

* Type.

Leon, 1: San Cristobal, Minorca, Balearic Islands, 7; Inca, Majorca, Balearic Islands, 6.

France: Cerbère, Pyrénées-Orientales, 1; near Nimes, Gard, 2; Valescure, Var, 1. The Gard and Var specimens not typical.

4 ♂, ♀.	Venta del Baul, Granada, Spain.	G. S. Miller (c).	8. 8. 4. 102–106.
4 ♂, 2 ♀.	Elche, Alicante.	G. S. Miller (c).	8. 8. 4. 89–94.
13 ♂, 8 ♀.	Alcoy, Alicante. (*N. Gonzalez.*)	O. Thomas (p).	8. 2. 9. 139–159.
4 ♂, ♀.	Silos, Burgos.	G. S. Miller (c). (8. 8. 4. 101.	8. 8. 4. 97–101. *Type* of subspecies.)
♂, ♀.	Castrillo, Burgos.	G. S. Miller (c).	8. 8. 4. 95–96.
♂.	Pajáres, Leon. (*N. Gonzalez.*)	O. Thomas (p).	8. 2. 9. 132.
4 ♂, 2 ♀.	Inca, Majorca, Balearic Islands.	O. Thomas and R. I. Pocock (p).	0. 7. 1. 18–23.
6 ♂, ♀.	San Cristobal, Minorca, Balearic Islands.	O. Thomas and R. I. Pocock (p).	0. 7. 1. 59–65.
♂.	Cerbère, Pyrénées-Orientales, France.	O. Thomas and R. I. Pocock (p).	0. 7. 1. 77.
♂.	St. Genies, Gard. (*C. Mottaz.*)	O. Thomas (p).	8. 8. 10. 92.

Mus spicilegus lusitanicus Miller.

1896. *Mus* sp. Thomas, The Zoologist, 3d ser., xx, p. 137, April, 1896.

1909. *Mus spicilegus lusitanicus* Miller, Ann. and Mag. Nat. Hist., 8th ser., iii, p. 422, May, 1909.

1910. *Mus spicilegus lusitanicus* Trouessart, Faune Mamm. d'Europe, p. 148.

Type locality.—Cintra, Portugal.

Geographical distribution. Known only from the vicinity of the type locality.

Diagnosis. General colour of upper parts brownish grey with a decided tinge of russet.

Colour.—Upper parts a light yellowish wood-brown with an evident russet tinge, the sides lighter and more buffy, the longer dark hairs producing an evident though not very conspicuous effect of "lining." A narrow clear buffy area along sides and accentuating line of demarcation, this continued forward over cheek but not surrounding eye. Underparts light cream buff, the slate-grey bases of the hairs showing through at surface. Feet buffy white or pale cream-buff. Tail obscurely bicolor, buffy whitish below, dark brown above, the dark area much wider than in the Spanish form and essentially as in *Apodemus sylvaticus*.

Measurements. Type (adult male): head and body, 77; tail, 60; hind foot, 16·2; ear, 13. Average and extremes of six adults from the vicinity of Cintra: head and body, 75·5 (74–77); tail, 61·8 (60–65); hind foot, 16·1 (15–16·8); ear, 12·6 (12–13). For cranial measurements see Table, p. 881.

Specimens examined.—Six, all from the neighbourhood of Cintra.

4 ♂, 2 ♀.	Cintra, Portugal.	O. Thomas (c & p).	98. 2. 2. 30–35. (98. 2. 2. 30. *Type* of subspecies.)

Genus **ACOMYS** I. Geoffroy.

1838. *Acomys* I. Geoffroy, Ann. des Sci. Nat., Paris, 2d ser., x, Zool., p. 126, August, 1838.
1841. *Acosmínthus* Gloger, Gemeinn. Hand- u. Hilfsbuch der Naturgesch., i, p. 95 (*dimidiatus*).
1842. *Acanthomys* Lesson, Nouv. Tabl. Règne Anim., Mamm., p. 135 (*hispidus*).

Type species.—*Mus cahirinus* E. Geoffroy.

Geographical distribution. Africa and south-western Asia; islands of Cyprus and Crete. Not known from any part of the mainland of Europe.

Characters. In general essentially like *Epimys*, but fur conspicuously spinous, and tail with unusually large scales, its appearance in most species suggesting that of a lizard; skull with anterior half of mesopterygoid fossa closed by plate-like outgrowth from the palatines, which meet and form a distinct longitudinal ridge in median line, the open part of fossa thus reduced to a small triangular space bounded chiefly by the hamulars; enamel pattern and relative sizes of molar crowns about as in *Epimys*, but m^1 three-rooted, its anterior lamina with inner tubercle somewhat displaced backward, though less so than in *Mus*.

Remarks.—The genus *Acomys* contains about fifteen species, one of which occurs within the limits of western Europe as here defined.

ACOMYS MINOUS Bate.

1906. *Acomys dimidiatus minous* Bate, Proc. Zool. Soc., London, 1905, ii, p. 321, April 5, 1906.
1910. *Acomys dimidiatus minous* Trouessart, Faune Mamm. d'Europe, p. 158.

Type locality.—Kanea, Crete.

Geographical distribution.—Island of Crete.

Diagnosis.—Like *Acomys dimidiatus* of Asia Minor, but smaller in size and darker in colour; skull noticeably smaller than in *dimidiatus*.

External characters.—Tail decidedly longer than head and body, the scales large and coarse, forming about ten rings to the centimeter at middle, the boundaries between the rings sharply defined, but those between the scales in each ring obsolete. Posterior border of each scale bearing two slender but distinctly flattened, closely appressed bristles, the length of which equals the width of about one and a half rings. These bristles are of a peculiar silvery horn-colour, and are so arranged as to form continuous longitudinal striæ, which, in connection with the conspicuous rings, impart to the tail a peculiar lizard-like appearance. Among the bristles occur numerous longer terete hairs so

slender that they can scarcely be detected without the aid of a lens. Hind foot with sole naked to heel, the usual six pads well developed, the spaces between them occupied by numerous secondary tubercles, some of which attain nearly the size of the primary pads. Fore foot with thumb reduced to a mere tubercle with rudimentary nail. Palm rather broad, with five main pads and numerous secondary tubercles. Ear rather large, extending about to middle of eye when laid forward, its surface finely pubescent. Fur at middle of back consisting entirely of flattened bristles about 11·5 mm. in length and about 0·4 mm. in breadth at widest region. The few woolly hairs which occur among the bristles are almost entirely concealed, though a few extend beyond tips of bristles, especially on rump. On sides, shoulders, head and underparts the bristles become so slender as to resemble ordinary coarse hair.

Colour.—Ground colour of sides and upper parts buff, clear and bright along sides, strongly tinged with ecru drab on head, neck and shoulders. Spines of back light bluish grey (nearly the pearl-grey of Ridgway) through basal two-thirds, then buff with the extreme tips horn-colour, the result being a peculiar coarse grizzle in which the buff decidedly predominates. On hind leg the buff extends down outer side to ankle, but on front leg it does not reach wrist. Underparts and feet creamy white, the line of demarcation sharply defined, and extending along sides of face to muzzle. Ears and tail dull brownish, the tail not so dark below as above.

Skull. In general appearance the skull resembles a miniature of that of *Epimys rattus*, owing to the approximately similar development and form of the ridges in interorbital region and on sides of brain-case. The brain-case is, however, more depressed posteriorly and relatively wider than in the members of the black rat group, the greatest width across lateral ridges equal to fully 1½ times length of parietal along ridge. Rostrum rather deeper and narrower than in other European *Murinæ*. Interparietal very large, strongly convex posteriorly, straight or slightly convex anteriorly, its area about equal to that of parietal. Incisive foramina extending back to about middle of first molar, their length only about 1 mm. less than that of diastema. Apart from its peculiar backward extension in median line characteristic of the genus, the bony

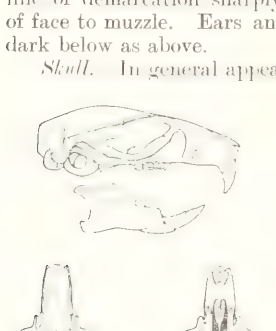


FIG. 180.

Acomys minosus. Nat. size.

palate is very short, its length from incisive foramen to the transverse ridge homologous with the normal posterior border scarcely exceeding breadth at middle of first molar. Hamulars diverging posteriorly, their tips broadly in contact with well developed beak of auditory bulla, the greatest distance between them about equal to length of interpterygoid space. Auditory bullæ moderately large but not specially inflated, their form more elongated transversely to main axis of skull than in members of the other European genera. Zygomata strong, somewhat expanded upward anteriorly (conspicuously more than in *Epimys rattus* or *Mus musculus*). Plate forming outer wall of infraorbital foramen broad, rather squarely rounded off above. Infraorbital foramen rather widely open below owing to the unusually slight protuberance formed by the root of upper incisor. Mandible with long, rather narrow and straight angular process, the lower border of which is folded squarely inward; coronoid process reduced to a mere recurved spicule scarcely rising above level of wide, nearly horizontal area extending from its base to articular surface. Protuberance over root of lower incisor slight.

Teeth.—Upper incisor strongly compressed, rather more so than in *Mus musculus*, the cutting edge normal. Lower incisor essentially like the upper tooth in cross section, its anterior and posterior diameters nearly equal. Molars suggesting those of *Mus musculus* both in relative size and in arrangement of tubercles, but the general tendency toward reduction carried less far, so that crown area of m^1 is about equal to that of m^2 and m^3 combined. First upper molar with crown relatively wider than in *Mus musculus*, but with *t*1 similarly though less displaced backward. Second upper molar with *t*3 represented by a rather evident antero-external shelf, usually bearing a minute tubercle; *t*9 relatively better developed than in the house mouse. Third upper molar with crown area equal to fully one-half that of m^2; *t*3 usually represented by a minute antero-external tubercle; second and third laminæ rather distinct, oblique, separated by a narrow groove, the extremities of which produce a slight re-entrant angle on each margin of crown, the tubercular elements entering into formation of the laminæ obsolete.* Lower molars as in

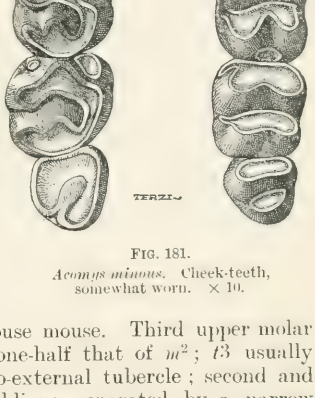


FIG. 181.
Acomys minous. Cheek-teeth, somewhat worn. × 10.

* In the specimen from which fig. 181 was drawn the crowns of the upper molars are sufficiently worn to obscure the pattern, particularly of m^3.

CRANIAL MEASUREMENTS OF *ACOMYS MINOUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Occipital breadth.	Breadth of brain-case at middle.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
Crete . .	5. 12. 2. 31	♂	28·0	14·8	5·0	11·0	7·8	11·8	7·8	17·0	5·0	4·4	Teeth moderately worn.
,, . .	5. 12. 2. 32	♀	—	—	5·0	—	—	11·6	7·6	17·0	5·0	4·4	,, ,,
,, . .	5. 12. 2. 33*	♂	—	15·2	5·0	—	—	11·6	7·8	17·2	5·0	4·4	,, ,,

* Type.

Mus musculus, but anterior portion of m_1 broader and with two sub-equal tubercles nearly as large as those of second lamina, and m_3 relatively larger, its crown area slightly more than half that of m_2.

Measurements.—Type (adult female): head and body, 94; tail, 113; hind foot, 18; ear, 19·5. Adult male from the type locality: head and body, 112; hind foot, 19; ear, 18. For cranial measurements see Table opposite.

Specimens examined :—
CRETE: Canea, 3.

2 ♂, ♀. Canea, Crete. Miss D. Bate (c). 5. 12. 2. 31-33. (5. 12. 2. 33. *Type* of species.)

FAMILY SPALACIDÆ.

1821. *Spalacidæ* Gray, London Med. Repos., xv, p. 303, April 1, 1821.

Geographical distribution.—South-eastern Europe and adjoining portions of Asia; south into Egypt.

Characters.—Form mole-like, highly modified for subterranean life; eye without external orifice; external ear reduced to a low ridge; tail absent; claws not specially enlarged; skull wedge-shaped, without postorbital processes, nearly half of its upper surface occupied by a flattened, forward-sloping occipital shield, the outer margin of which extends to level of outer border of zygomatic root; jugal short, extending forward only a little beyond middle of zygoma and forming no part of anterior portion of arch; infraorbital foramen large, simple; parapterygoid fossa not closed dorsally, appearing like a large foramen; cheek-teeth $\frac{3\cdot3}{3\cdot3}$, rooted, hypsodont, the subterete crowns with one inner and one or two outer re-entrant folds.

Remarks.—Both externally and in the structure of the skull the family *Spalacidæ* exhibits a higher degree of special adaptation to a peculiar mode of life than any other group of rodents occurring in Europe. As here understood the family consists of the single genus *Spalax*.

Genus **SPALAX** Gueldenstaedt.

1770. *Spalax* Gueldenstaedt, Nov. Comm. Acad. Sci. Imp. Petrop., xiv, pt. i, p. 410 (*microphthalmus*).

1783. *Myospalax* Hermann, Tabula Affinitatum Animalium, p. 83 (*laxmanni* Hermann = *Spalax microphthalmus* Gueldenstaedt).

1799. *Talpoides* Lacépède, Tableau des divisions, sous-divisions, ordres et genres des Mammifères, p. 10 (*typhlus*).

1804. *Aspalax* Desmarest, Nouv. Dict. d'Hist. Nat., xxiv, Tab. Méth. Mamm., p. 24 (*Mus typhlus* Pallas).

1815. *Anotis* Rafinesque, Analyse de la Nature, p. 58 (Substitute for *Talpoides* Lacépède).

1840. ? *Ommatostergus* Nordmann in Keyserling and Blasius, Wirbelthiere Europas, pp. VII, 31 (*O. pallasii* Nordmann). Nomen nudum.

1898. *Microspalax* Nehring, Sitz.-Ber., Gesellsch. Naturforsch. Freunde, Berlin, for December 21, 1897, p. 168 (Provisional sub-generic name for smaller species of *Spalax*). Not *Microspalax* Trouessart, 1885.

1903. *Nannospalax* Palmer, Science, N.S., XVII, p. 873, May 29, 1903 (Substitute for *Microspalax* Nehring).

Type species.—*Spalax microphthalmus* Gueldenstaedt.

Geographical distribution. South-eastern Europe and adjoining portions of Asia; south into Egypt. Limits of range imperfectly known.

Characters. Essential characters as in the family *Spalacidæ*. Fur soft and velvety except for a conspicuous line of stiffened bristles extending backward along each side of head from outer extremity of naked muzzle pad. Pattern of enamel folding at first sigmoid, but later, as the crowns of the teeth wear away, undergoing considerable changes in form, the re-entrant folds tending to become isolated as enamel islands (fig. 184, p. 893).

Remarks. The members of the genus *Spalax* are immediately recognizable among European rodents by their complete adaptation to underground life, the absence of external eyes and tail, and the presence of the peculiar line of stiffened bristles on each side of head. About a dozen species have been described; two of these inhabit south-eastern Europe west of the Russian boundary, while a third, of uncertain status, is supposed to occur in Greece.

KEY TO THE EUROPEAN SPECIES OF *SPALAX*.*

Skull not unusually deep, the distance from alveolus of m^3 to sagittal crest about 39 per cent of condylobasal length; width of auditory bulla about 7 mm.; greatest width of infraorbital foramen slightly more than half its height (Roumania and Bulgaria)..... *S. dolbrogæ*, p. 889.

Skull unusually deep, the distance from alveolus of m^3 to sagittal crest about 43 per cent of condylobasal length; width of auditory bulla about 8 mm.; greatest width of infraorbital foramen conspicuously more than half height.

Breadth of rostrum in adult male about 11 mm.; alveolar breadth of m^1 equal to least palatal width (Hungary)..... *S. hungaricus*, p. 894.

Breadth of rostrum in adult male about 12 mm.; alveolar breadth of m^1 less than least palatal width (Greece?)..... *S. græcus*, p. 895.

* The important work by Dr. L. Méhely on this genus—Species generis *Spalax*. A Földi Kutyák Fajai. Budapest, 1909—has unfortunately been received too late to be utilized by the author.—O. T. (See Appendix, p. 1000.)

SPALAX DOLBROGEÆ Miller.

1901. *Spalax hungaricus* Matschie, Sitz.-Ber. Gesellsch. Naturforsch. Freunde, Berlin, p. 237, November, 1901 (Roumania).

1903. *Spalax dolbrogæ* Miller, Proc. Biol. Soc., Washington, xvi, p. 161, November 30, 1903 (Dobrudscha). Type in U.S. National Museum.

1910. *Spalax dolbrogæ* Trouessart, Faune Mamm. d'Europe, p. 204.

Type locality.—Malcoci, Dobrudscha, Roumania.

Geographical distribution. Roumania and Bulgaria; limits of range not known.

Diagnosis.—Size medium (hind foot about 25 mm., condylobasal length of skull about 50 mm.); skull moderately deep, the distance from alveolus of m^3 to sagittal crest about equal to that from occipital condyle to first molar; anteorbital foramen large, much higher than wide; anterior base of zygoma lightly built; auditory bullæ rather long and narrow; breadth of m^1 at alveolus less than width of palate in same region.

External characters.—General form cylindrical, with long body, short legs and no apparent neck, the broad flattened head set so closely on shoulders that orifice of ear is almost at anterior edge of scapula. Head broadly rounded when viewed from above, wedge-shaped in profile owing to the abrupt reduction in depth from behind forward, the anterior border of muzzle pad forming the front edge of wedge, the chin strongly receding; external ear absent, the small auditory opening margined by a low ridge, no trace of external eye; nostril pad large, lying in two distinct planes, one on upper surface of muzzle, the other on abruptly backward-sloping upper lip; upper portion of pad broadly triangular in outline, its longest border in front, its surface smooth except for some indistinct wrinkles crossing it longitudinally, and a deep groove at each side parallel with margin; lower portion similar to upper in general outline, the simple, round nostrils situated a little below middle; a narrow groove curving outward and upward from each nostril to anterior margin of pad; lip thinly haired between pad and mouth. The shovel-like character of upper surface of head is increased by the presence of a brush of stiffened hairs directed outward and upward, and extending from outer angle of muzzle pad about half-way to ear. Legs short, the feet large and distinctly fossorial. Fore foot with third digit longest, second and fourth successively a little shorter, fifth extending to end of first phalanx of fourth, first very short, not extending to middle of first phalanx of second; claws simple, very small, their length not equal to that of terminal phalanx; palm naked, the region at base of phalanges wrinkled but without tubercles, the posterior portion occupied by a large pad divided into two unequal parts by a longitudinal furrow on side next thumb, the anterior margin raised and thickened, sometimes appearing as a ridge

crossing palm obliquely outward and backward from base of thumb. Hind foot longer and more slender; proportions of digits as in fore foot, but claws of second and third about three times as long as the others, which are of the usual small size; in old individuals the second and third claws may be worn down to essentially the same size as the others; sole naked, finely wrinkled; three small, ill-defined tubercles at bases of main digits, and a fourth at base of hallux; a faintly indicated fifth on opposite side of sole from fourth. Tail a mere tubercle barely 1 mm. in height.

Colour.—Back, sides and posterior half of head a light yellowish brown somewhat paler than the ochraceous-buff of Ridgway, the fur everywhere slate grey beneath surface; underparts and legs slate grey, the yellowish brown of sides usually extending as an evident wash across middle of body; face, cheeks and region about mouth silvery drab-grey, the two lines of bristle-like hairs extending back from muzzle whitish in rather marked contrast.

Skull.—The skull is heavily-built, its surface conspicuously ridged, its general form strongly cuneate whether viewed from above or from the side. Dorsal profile slightly convex from front of nasal to lambdal region, the convexity most marked between orbits, the nasals and upper surface of brain-case often flattened or faintly concave; occiput very gradually sloping at an angle of about 10°, the length of this sloping portion equal to distance from lambda to posterior extremity of nasals; ventral profile concave immediately behind incisor, then sloping abruptly downward to front of alveolus, from which point it is essentially horizontal to back of occipital condyle. Brain case broadly ovate in outline when viewed from above, the broad occipital shield causing it to appear almost triangular; sagittal crest well developed in adult, extending from lambdoid crest to interorbital constriction; occipital shield extending so far forward that the conspicuous, almost squarely transverse lambdoid crest is continuous at its outer extremity with anterior border of zygomatic root, into basal portion of which the antero-external angle of shield appears to be pressed; outer border of shield extending as a thin plate from auditory meatus to base of zygoma, and roofing over a pit-like area lying between glenoid surface and neck of bulla; posterior aspect of brain-case entirely covered by the pentagonal occipital shield, no portion of brain-case or interorbital region appearing above its upper margin; lower border of shield longest, postero-external border shortest, antero-external border intermediate in length; foramen magnum squarish in outline, its height less than half that of shield; paroccipital processes distinct but small, not extending to level of lower border of foramen magnum; condyles projecting noticeably behind all other parts of occiput; base of brain-case with no specially remarkable features; width of basioccipital behind

nearly twice length excluding condyles, width along anterior suture about two-thirds median length; surface of basioccipital irregularly depressed at side; auditory bullæ rather large, but displaced upward so that lower border is about on level with that of foramen magnum, their outline somewhat flask-shaped, the neck of the flask projecting horizontally outward, not abruptly defined from body of bulla; surface of bulla smoothly

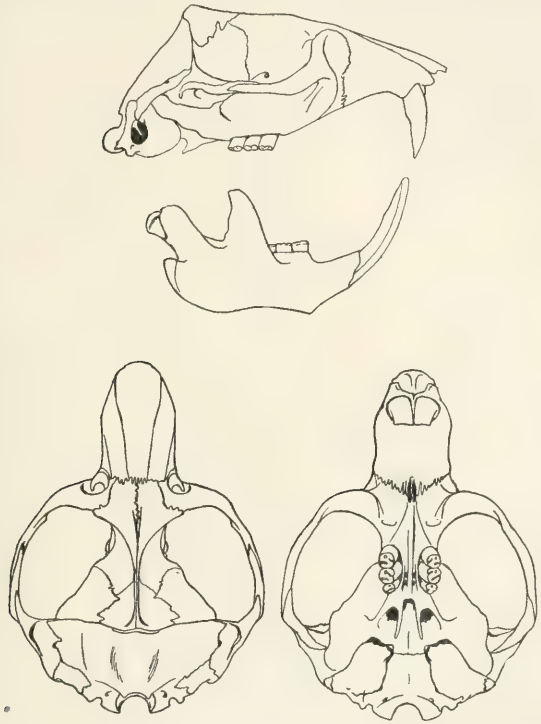


FIG. 182.
Spalax dolbrogeæ. Nat. size.

polished. Interorbital region deeply constricted, its upper surface marked by a narrow median groove extending forward from sagittal crest. Zygoma slender and weak, not expanded at middle, nearly horizontal throughout, bowed gradually outward, so that the greatest zygomatic breadth is at level of anterior extremity of glenoid surface; infraorbital foramen large, broadly crescentic in outline, its greatest width scarcely or not more

than half height. Rostrum rather long, nearly parallel-sided when viewed from above, though slightly wider somewhat beyond middle than at base, and tapering rather noticeably in front, its width everywhere greater than that of interorbital constriction; nasals wide, abruptly rounded off anteriorly, where they project so as to conceal incisors, tapering gradually to a narrow base, where they are abruptly truncate at level of posterior extremity of nasal branches of premaxillaries, and of middle of infraorbital foramina; in lateral view the rostrum is strongly cuneate, its least depth, immediately behind incisors, contained about $2\frac{1}{2}$ times in that at alveolus of m^1; incisive foramina very small, slit-like, at level of anterior border of zygomatic root, their greatest diameter contained about six times in diastema (three times in space in front of them, twice in that behind). Palate very narrow, its least breadth scarcely equal to that of alveolus, its surface marked by a median ridge and two lateral grooves; posterior termination of palate simple, without pits or changes of level; mesopterygoid space parallel-sided, about twice as long as wide, squarely truncate anteriorly at level a little behind that of alveolus of m^3; hamulars simple, straight, slightly diverging, widely separated from bullæ; ectopterygoid narrow, the pit deep and widely open at bottom. Mandible slender, appearing disproportionately small for the very large incisor which projects conspicuously behind as well as in front, and to which the ramus is little more than a sheath; coronoid process high, slightly recurved, its anterior border rising abruptly from level of front of m_2; articular process low, its base distorted by the shaft of incisor; angular process with rather long, strongly convex lower border, its free portion short, abruptly curved outward, not extending behind level of condyle; between articular and angular processes and somewhat in front of them projects outward and upward the encapsuled base of the incisor, rising in fully adult individuals to a height intermediate between that of articular and coronoid processes, and forming the most conspicuous single feature of this part of jaw.

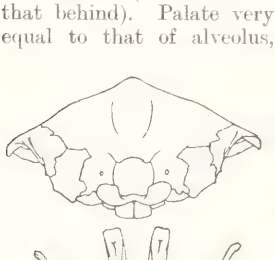


Fig. 183.

Spalax dilbrancæ. Skull from behind. Nat. size.

Teeth. Incisors large and heavy, molars small, the contrast greater than in any other European rodent. Upper incisor strongly curved, the exposed portion nearly vertical, the root forming a slight protuberance at side of palate immediately in front of first molar; shaft not compressed, the width of flat anterior face nearly equal to greatest antero-posterior diameter; posterior

border narrowly rounded; inner and outer borders about equal; enamel extending slightly on inner and outer sides of tooth, its surface finely rugose with minute longitudinal wrinkles, and light orange in colour. Lower incisor so large that the mandible has the appearance of a mere sheath to the tooth, its root projecting between articular and angular processes as a conspicuous sub-terete capsule, larger and more noticeable than the processes themselves; length of capsule increasing with age, scarcely or not attaining level of condyles in individuals whose molars are in the early stages of wear, though surpassing this level in

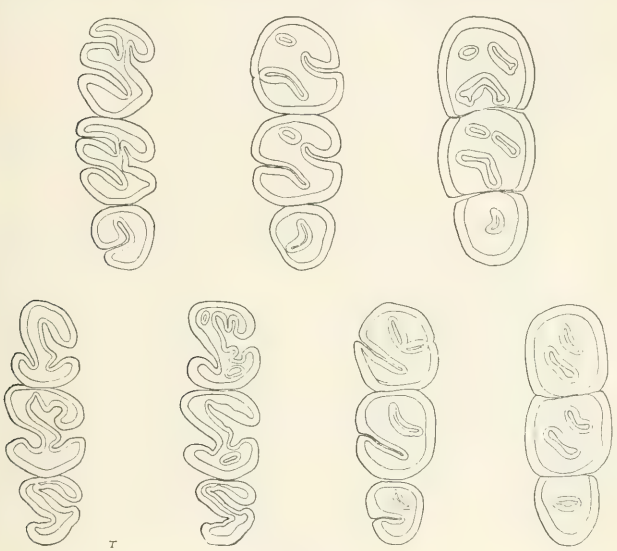


FIG. 184.

Spalax dolbrogeæ. Cheek-teeth showing enamel pattern at various stages of wear. Upper row, maxillary teeth; lower row, mandibular teeth (semi-diagrammatic). × 5.

older animals; section of shaft much as in upper tooth, but antero-posterior diameter relatively greater; surface of enamel less evidently rugose, and colour whitish or slightly tinged with yellow. Molars with high, sub-terete crowns and short roots, of which there are three in each of the maxillary teeth, the inner root tending to divide longitudinally into two, and two in each of the mandibular teeth, each root tending to divide into two; size of teeth decreasing from first to third, the crown area of third when unworn about one-half that of first, when worn relatively larger; enamel pattern of m^1 and m^2 consisting of two backwardly curving re-entrant folds on outer side and a single

foward-curving re-entrant fold on inner side, the anterior outer fold of m^2 shallower than the others and usually becoming converted into an "island" at an early stage of wear; m^3 with re-entrant fold on either or both sides; lower molars each with a forward-curving more anterior inner fold and a backward-curving more posterior outer fold, the inner fold in m_1 and m_2 with a small supplemental basal backward fold which early becomes isolated as a minute island lying near apex of outer fold; all the re-entrant folds in both maxillary and mandibular teeth are transformed into islands as the wearing away of crown advances.

Measurements. Type (adult male): head and body, 230; hind foot, 25 (hind foot with claws, 29). For cranial measurements see Table, p. 896.

Specimens examined.—Nine, from the following localities:—
BULGARIA: Near Rustschuk, 6 skulls (Andersen).
ROUMANIA: Malcoci, Dobrudscha, 3 (B.M. and U.S.N.M.).

♂, ♀. Malcoci, Dobrudscha, Roumania. G. Dalgleish (c). 5. 10. 25. 1–2.

SPALAX HUNGARICUS Nehring.

1898. *Spalax typhlus hungaricus* Nehring, Sitz.-Ber. Gesellsch. Naturforsch. Freunde, Berlin, for December 21, 1897, p. 173, fig. 3.
1898. *Spalax hungaricus* Nehring, Zool. Anzeiger, XXI, p. 479, September 5, 1898.
1898. ? *Spalax monticola* Nehring, Sitz.-Ber. Gesellsch. Naturforsch. Freunde, Berlin, p. 6 (Ulog-Obruja, Herzegovina).
1910. *Spalax hungaricus* and ? *S. monticola* Trouessart, Faune Mamm. d'Europe, pp. 203, 204.

Type locality.—Hungary; exact locality not stated.
Geographical distribution.—Hungary; probably extending southward into north-western portion of Balkan Peninsula.

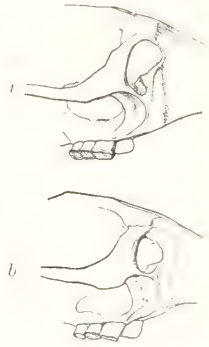


FIG. 185.
Anterior base of zygoma in *Spalax dolbrogiæ* (*a*) and *S. hungaricus* (*b*). Nat. size.

Diagnosis.—Like *Spalax dolbrogeæ*, but skull tending to be somewhat deeper; anteorbital foramen moderate, nearly as wide as high; anterior base of zygoma heavy; auditory bullæ rather short and wide; breadth of m^1 at alveolus about equal to width of palate in same region.

Specimens examined.—Austria-Hungary, Kolozsvar, 2; Hungary, no exact locality, 2 (U.S.N.M.).

2.	Kolozsvar, Hungary. (*L. Führer.*)	O. Thomas (P).	3. 1. 14. 1–2.

SPALAX GRÆCUS Nehring.

1898. *Spalax græcus* Nehring, Zool. Anzeiger, XXI, p. 228, March 21, 1898. Type in Munich Museum.

1910. *Spalax græcus* Trouessart, Faune Mamm. d'Europe, p. 204.

Type locality.—Supposed to be the neighbourhood of Athens, Greece.

Geographical distribution.—Known only from the two original specimens and a young male from Stylis too immature to be positively identified.

Diagnosis.—Similar to *Spalax hungaricus*, but skull with somewhat broader rostrum and palate.

External characters and colour.—As in *S. hungaricus*.

Skull and teeth.—In all respects the skull and teeth resemble those of *Spalax hungaricus*, as opposed to *S. dolbrogeæ* (great depth through frontal region; form of auditory bullæ; width of infraorbital foramen), but the rostrum appears to be slightly broader and the nasals a little more spatulate than in the northern animal. Teeth exactly as in *S. hungaricus*, except that molars are relatively somewhat narrower, a peculiarity that may readily prove to be individual. The enamel pattern of the adult agrees with that of *S. hungaricus* in all respects except in the slightly less development of the longitudinal terminations of the outer re-entrant folds, a peculiarity probably due to the condition of wear in which the crowns happen to be.

Measurements.—Hind foot of adult, 27 mm. For cranial measurements see Table, p. 896.

Specimens examined.—The skeleton and mounted specimen in the Munich Museum which formed the basis of the species: also an immature male from Stylis.

Remarks.—Through the kindness of the authorities of the Munich Museum I have had the opportunity to compare the original specimens of *Spalax græcus* with *S. hungaricus* and *S. dolbrogeæ*. Since the species was described the skull has been removed from the adult individual. This specimen shows that the teeth, contrary to the supposition of the original describer, have no characters that can be regarded as specific. If distinct from *S. hungaricus*, the larger animal is not likely to be separable by any other character than its size.

♂.	Stylis, Phthiotis, Greece.	E. MacDonell (C & P).	9. 3. 15. 1.

CRANIAL MEASUREMENTS OF *SPALAX DOLBROGEÆ*, *S. HUNGARICUS* AND *S. GRÆCUS*.

Locality.	Number.	sex.	Greatest length.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Breadth of rostrum at middle.	Nasal.	Condyle to alveolus of m^3.	Diastema.	Depth to alveolus of m^3.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
S. dolbrogeæ.															
Roumania: Malcoci, Dobrudscha	122109*	♂	51·8	48·4	37·8	6·2	11·4	19·6	18·8	19·0	18·8	31·4	7·4	6·8	Teeth much worn.
,, ,,	5. 10. 25. 1	♂	48·0	44·8	35·0	7·0	10·0	18·4	17·0	17·2	19·0	29·4	7·6	6·8	,, ,,
Bulgaria	Andersen		49·0	45·0	35·6	8·0	10·6	19·0	17·8	18·0	19·4	31·0	7·0	6·8	,, ,,
S. hungaricus.															
Austria-Hungary: Kolozsvar, Hungary	3. 1. 14. 1		50·0	47·0	36·0	8·4	11·0	19·8	17·8	17·4	20·4	30·0	8·2	7·8	,, ,,
S. græcus.															
Near Athens, Greece? . .	Munich	♂				8·6	11·8	20·0	–	18·0	22±	31·6	8·2	8·0	,, moderately worn.
,, . .	,, *	juv.	48·0	45·2	34·6	10·0	10·8	18·8	18·0	16·2	19·0	31·0	8·2	8·0	,, slightly worn.

* Type.

Family SCIURIDÆ

1821. *Sciuridæ* Gray, London Med. Repos., xv, p. 304, April 1, 1821.

Geographical distribution. Eastern and western hemispheres except at the extreme north and south; absent from Madagascar, New Guinea, Australia and the Pacific Islands.

Characters.—Form slender or robust according as the animal's habits are arboreal or terrestrial; tail without horny scales on lower surface, densely long-haired, usually flattened; ribs twelve or thirteen pairs; skull varying in form but never highly modified; postorbital processes present; infraorbital foramen small; jugal long, its anterior extremity wedged between lachrymal and zygomatic process of maxillary; palate rather broad; upper incisor with root in front of anterior cheek-teeth, lower incisor with root not extending conspicuously into ascending portion of ramus; molars rooted, tubercular and transversely ridged, premolars $\frac{2}{1}$ or $\frac{1}{1}$.

Remarks.—The family *Sciuridæ*, containing the squirrels, spermophiles, marmots and their allies, is one of the most widely distributed and abundantly represented group of rodents. It contains about forty-five living groups, the exact status of many of which is still in doubt; three of these occur in Europe.

KEY TO THE EUROPEAN GENERA OF *SCIURIDÆ*.

(For convenience of comparison the cranial and dental characters of *Sciuropterus* are inserted.)

[Orbit large, its vertical diameter equal to more than one-third basilar length of skull; posterior transverse ridge on crown of first and second upper molar terminating internally in a distinct cusp isolated by deep groove; axes of enamel foldings of lower cheek-teeth not parallel..... *Sciuropterus*, p. 941.]

Orbit moderate or small, its vertical diameter equal to less than one-third basilar length of skull; posterior transverse ridge on crown of first and second upper molar terminating internally without cusp and groove; axes of enamel foldings of lower cheek-teeth parallel.

Incisors compressed, the width of anterior face not more than half that of lateral face; small upper premolar minute, its crown simple, with diameter equal to about one-eighth that of large premolar; dorsal profile of skull strongly depressed posteriorly; tail nearly as long as head and body, very bushy (Habits arboreal, Squirrels)..... *Sciurus*, p. 898.

Incisors not compressed, the width of anterior face about equal to that of lateral face; small upper premolar well developed, its crown marked by evident ridges and depressions, its diameter about half that of large premolar; dorsal profile of skull not very strongly depressed posteriorly (Habits terrestrial).

Brain-case not excessively flattened, its depth about twice that of rostrum; distance from lachrymal to tip of postorbital process equal to about one-third condylobasal length of skull; size medium or small, form squirrel-like (Ground squirrels)..... *Citellus*, p. 924.

Brain-case much flattened, its depth not conspicuously greater than that of rostrum; distance from lachrymal to tip of postorbital process less than one-fourth condylobasal length of skull; size large, form badger-like (Marmots)..... *Marmota*, p. 931.

Genus SCIURUS Linnæus.

1758. *Sciurus* Linnæus, Syst. Nat. i, 10th ed., p. 63 (*vulgaris*, by tautonymy).

1857. *Sciurus* Blasius, Säugethiere Deutschlands, p. 271.

1893. *Aphrontis* Schulze, Zeitschr. für Naturwissensch., Leipzig, LXVI, p. 165 (*vulgaris*).

Type species. *Sciurus vulgaris* Linnæus.

Geographical distribution. Forested regions of the northern hemisphere, in the Old World from Ireland to Japan and northeastern Siberia; southern limits of distribution at present uncertain owing to lack of precise definition of the genus.

Characters.—Strictly arboreal *Sciuridæ*, of medium size and typically sciurine aspect, the tail bushy and conspicuously flattened, more than half as long as head and body; skull with deep, strongly convex brain-case and weak rostrum; postorbital processes slender, directed backward; incisors strongly compressed; anterior upper premolar vestigial, usually present as a practically functionless terete spike; crowns of molars low, those of upper teeth with two moderately developed cross ridges and a broad, low inner cusp (not forming a U-shaped pattern with wear), those of lower teeth distinctly basin-shaped.

Remarks.—In the present uncertainty regarding the classification of the squirrels, it is impossible to frame a satisfactory diagnosis of the genus *Sciurus*, or to estimate the number of forms that should be referred to the group. Only the type species occurs within the limits of the present work; it is represented by thirteen geographical races.

SCIURUS VULGARIS Linnæus.

(Synonymy under subspecies.)

Geographical distribution. Wooded portions of Europe from the extreme northern limits of tree growth to the Mediterranean coast, and from Ireland eastward into Asia.

Diagnosis.—Size medium (head and body ranging in the different races from 205 to 280 mm., tail from 160 to 242, hind foot from 55 to 66, condylobasal length of skull from 45 to 55);

tail decidedly more than half as long as head and body; ear conspicuously tufted in winter; colour reddish, greyish or dark brown above, whitish (never distinctly yellowish) below; minute anterior upper premolar present; cross-ridges on upper molars smooth, not tending to become tuberculate; lower incisors extremely compressed.

External characters.—Form slender, the head and neck well differentiated from the trunk, the legs rather long, the tail about equal to head and body. Head rounded posteriorly, narrowed in front, the muzzle deep and not much produced (distance from eye to nostril about equal to depth at region half way between); ear rather large, just covering eye when laid forward, the width at middle about three-quarters height from crown; anterior border nearly straight below, somewhat convex above, its lower two-thirds abruptly folded backward, the inner root of this fold lying nearly over meatus; tip rather abruptly rounded off; posterior border convex except for a flattened or slightly convex region just below tip, its lower border extending forward as an abruptly angled projection over meatus; outer surface of ear densely furred at all seasons, the tip conspicuously tufted in winter pelage; muzzle pad hairy above, a narrow bare area extending between nostrils and across upper lip and sending out a lateral branch under each nostril. Fore feet long and slender with long, freely spreading fingers; thumb reduced to a mere tubercle with closely appressed nail; two middle fingers sub-equal and longest, second and fifth sub-equal and about half as long; palm with five tubercles, the two posterior largest and best defined; claws long, compressed, strongly curved. Hind foot long, the five toes all well developed and bearing strong claws shorter and less curved than those of fore foot; inner toe extending about to base of others, outer extending a little beyond middle of fourth; fourth toe longest, third and second successively a little shorter; sole densely hairy in winter, partly bare in summer; four small but evident tubercles at bases of toes. Tail strictly distichous throughout, the hairs at sides and above about 30 to 50 mm. in length. Mammæ, $p\ 1-1$, $a\ 2-2$, $i\ 1-1=8$.

Colour.—Though the actual colour shows great differences according to phase and season the pattern is constant and characteristic. The head, back, sides and tail are essentially uniform, the tail usually a little darker than back, the sides of body and outer surface of limbs somewhat lighter, the middle of back frequently with more red; face with an ill-defined pale area on cheeks and muzzle; ear-tufts usually concolor with surrounding parts but sometimes darker or more red; inner surface of legs and upper surface of feet not so dark as outer surface of legs; tail with a lighter, grizzled or whitish area along median line below, this sometimes partly or wholly concealed; white of underparts extending forward to chin or to back of interramal space; posteriorly the white does not reach base of tail, and

laterally it barely extends on inner surface of thigh and forearm: line of demarcation well defined. Two colour phases occur, one characterized by the predominance of red, the other by that of a dark, sometimes almost blackish brown. The dark phase is often incorrectly spoken of as melanistic. In a general way the phases have a geographical significance, as the red is dominant at the north, the dark brown at the south. The winter pelage is everywhere lighter, brighter and more greyish than the summer pelage. In regions where both colour phases occur four normal combinations of phase and pelage will be found in any considerable series of specimens. Apart from these combinations and their intermediate stages individual variation in colour is not unusually great.

Skull. In general the skull is broad, smooth and rounded, with large, deep brain-case and small rostrum, the basicranial

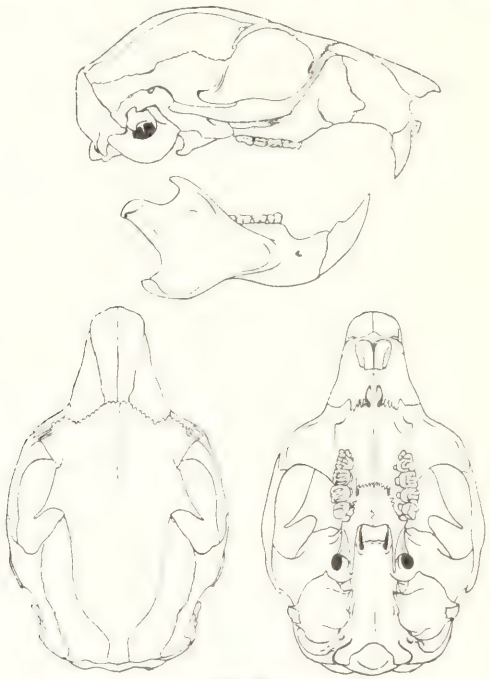


Fig. 180.
Sciurus vulgaris. Nat. size.

axis bent downward so that foramen magnum is entirely below level of alveolar line. Dorsal profile flat or faintly and irregularly

convex to region between postorbital processes, then abruptly and strongly convex over greater portion of brain-case to a slight but evident concavity immediately in front of lambdoid region; ventral profile somewhat parallel to dorsal profile in general direction, but diverging slightly in its anterior half and converging a little posteriorly; posterior truncation of brain-case nearly vertical, slightly convex when viewed from the side, the occipital condyles not visible from above. Brain-case broadly ovate in outline when viewed from above, its greatest width about equal to length, its width posteriorly somewhat greater than that at postorbital constriction; surface essentially smooth, though in old individuals, particularly of the larger races, a low ridge extends backward from base of postorbital process, across middle of parietal to lambdoid region, the two ridges together forming a lyrate figure; lambdoid crest represented by a mere angular ridge along course of lambdoid suture; viewed from the side the brain-case is conspicuously rounded through anterior three-fourths, the low occipital region marked off from main portion by a shallow but evident constriction; occiput moderately high, its depth to lower lip of foramen magnum about two-thirds mastoid breadth, much exceeded by median portion of brain-case, its dorsal and lateral margins forming an evenly rounded, nearly semicircular arch; foramen magnum wider than high; occipital with three distinct swellings between foramen magnum and lambdoid ridge, each about equal to exposed portion of petrosal; paroccipital processes small, their extremities hooked inward and slightly forward, scarcely extending to level of lower edge of condyle; basioccipital rather broad and short, its width in region of suture about equal to median length; median ridge slightly developed; edge of basioccipital in region of suture slightly raised, but not forming a distinct lateral process; auditory bullæ sub-circular in general outline, rather evenly inflated, but with an evident antero-internal flattening, their antero-posterior diameter equal to distance from front of bulla to front of m^3, their lateral diameter to inner margin of meatus barely equal to least width of basioccipital; meatus with a distinct rim except along postero-upper border. Interorbital region about as broad as long, its least width nearly the same as postorbital constriction, its surface nearly flat, though usually with a low but evident swelling at each side posteriorly, the bases of postorbital processes about on level with median region; notch at anterior base of postorbital process small but well developed, the orbital border sometimes complete so as to transform the notch into a foramen; postorbital processes long, slender, strongly bent downward, the orbit surrounded by bone through about three-quarters of its circumference. Zygomata not widely spreading either in front or behind, the arches essentially parallel with each other through the greater part of their extent; jugal projecting posteriorly behind zygomatic process of squamosal, its

upper border rising at middle to form a slight but evident angle marking hinder margin of orbit, its anterior extremity wedged between lachrymal and zygomatic process of maxillary ; anteorbital foramen small and slit-like, a little in front of level of anterior premolar, its outer border strongly concave, its lower extremity marked by a short abruptly projecting process. Rostrum forming about one-third length of skull, its base rather broad, its anterior region narrow and compressed, the least depth behind incisors decidedly greater than width at same region ; nasals rather short, moderately narrowed posteriorly, their squarely truncate hinder border lying at level of extreme anterior edge of zygomatic root, the broadly expanded nasal branches of premaxillaries usually extending somewhat further back. Palate moderately wide, slightly concave antero-posteriorly, rather noticeably concave laterally between tooth-rows ; incisive foramina small, lying entirely in premaxillaries, their length barely more than one-third that of diastema and much less than least width of rostrum, their anterior extremities very narrow ; posteriorly the palate extends a little beyond level of last molar, its border truncate or convex, never with median spine ; a conspicuous foramen or notch at outer edge of palate behind alveolus of m^3 ; mesopterygoid space less than twice as long as wide, its lateral borders nearly parallel except posteriorly, where the hamulars curve rather noticeably outward ; ectopterygoid slightly developed and inconspicuous. Mandible robust, the ramus deep and noticeably compressed in front of tooth row ; coronoid process broad at base, tapering rapidly to an acute recurved point a little above level of condyle, its anterior border moderately convex ; articular process with shallow but noticeable concavity on outer surface ; angular process well defined by the deep curve of its lower border.

Teeth. Upper incisor robust, but course of shaft not conspicuously marked on side of rostrum, and root producing no visible protuberance ; shaft strongly compressed, its cross section elliptical in outline, flattened in front, the enamel very thin, extending backward slightly on both outer and inner side, and covering less than one-third circumference of tooth, its surface finely pitted, yellow ; lower incisor with root extending into ascending portion of ramus and forming a slight protuberance on outer surface a little above level of crowns of molars, its shaft much more compressed than that of upper tooth, its outline ovate, narrowest in front, the enamel confined to narrow anterior surface. Anterior upper premolar a simple terete spike about as large as anterior outer root of succeeding tooth, its crown when unworn with slightly developed anterior tubercle and posterior depression, the area of crown barely more than one-tenth that of pm^4. Molariform teeth resembling each other in general size and form, each with two roots on outer side and a single larger root on inner side, the inner border of crown formed

by a single low, elongated tubercle, its height much less than length of base, the width of base scarcely more than half its length, the median portion concave transversely, the concavities of the four teeth forming together a longitudinal furrow, the outer side, except of m^3, with four low cusps from which transverse ridges extend inward on or across crown, their general direction somewhat obliquely forward. The usual scheme of the outer cusps and their ridges is as follows: first cusp low, its ridge forming anterior margin of crown and extending to inner extremity of base of inner tubercle; second cusp nearly twice the height of first, its ridge extending to side of base of inner tubercle; third cusp like first, its ridge extending only about half way across crown; fourth cusp like second, its ridge extending to slightly behind middle of base of inner tubercle; posterior base of inner tubercle continued outward along hinder

FIG. 187.
Sciurus vulgaris. Cheek-teeth. × 5.

border of crown as an ill-defined ridge extending nearly to base of fourth outer cusp. The principal deviations from this pattern are: in pm^4, first outer cusp nearly as large as second, fourth transverse ridge with an evident tubercle near its inner extremity; m^3, all the outer cusps together with their transverse ridges obsolete except the second, the posterior two-thirds of crown occupied by a shallow basin-like depression. Lower premolar with three roots, lower molars with four. Crowns squarish in outline, that of m_3 longer than broad, the others slightly broader than long, that of pm_4 with antero-external border so rounded off as to give the crown a somewhat triangular outline. Main portion of crown occupied by a smooth depression, on both outer and inner edge of which are three low tubercles, the anterior and posterior outer having the broadest and best defined bases, while the anterior internal is the highest; on each

side the median tubercle is much smaller than either of the two between which it lies.

Remarks.—The common squirrel in any of its geographical or seasonal phases is so readily distinguishable among the mammals of Europe as to require no special comparisons with other members of the fauna.

KEY TO THE EUROPEAN FORMS OF *SCIURUS VULGARIS*.

White of underparts restricted to median region; hind foot about 50 mm. (Southern Spain)..... *S. v. laticus*, p. 923.
White of underparts not restricted to median region; hind foot 55 to 70 mm.
Tail drab, fading in spring and summer to pale buff, never strongly reddish or blackish (British Islands)..... *S. v. leucourus*, p. 907.
Tail varying from red to black, never drab or buffy.
Condylobasal length of skull usually about 49 to 55 mm.; mandible 34 to 37·6 mm. (Spain).
Tail without white on under surface; skull 49 to 51 mm. (North-central Spain)..... *S. v. numantius*, p. 914.
Tail usually with conspicuous whitish median area on under side (this sometimes represented by a few white hairs only).
Muzzle and cheeks rusty (Central Spain)..... *S. v. infuscatus*, p. 916.
Muzzle and cheeks whitish or pale grey (South-western Spain)..... *S. v. seguræ*, p. 917.
Condylobasal length of skull usually about 44 to 49 mm.; mandible 31 to 34 mm.
Dark brown phase essentially absent (Northern).
Winter pelage smoke-grey, the back strongly tinged with red (Scandinavian Peninsula, except extreme north)..... *S. v. vulgaris*, p. 905.
Wintor pelage pearl-grey, the back scarcely or not tinged with red (Extreme north of Scandinavian Peninsula, east into Russia)..... *S. v. cacicus*, p. 906.
Dark brown phase not infrequent, sometimes dominant (Central and southern).
Upper parts in dark brown phase much darker anteriorly than posteriorly (Greece)..... *S. v. lilæus*, p. 913.
Upper parts in dark phase not noticeably darker anteriorly than posteriorly.
Rostral portion of skull unusually short and broad (Pyrenees)..... *S. v. alpinus*, p. 914.
Rostral portion of skull normal.
Winter pelage of red phase essentially without suffusion of grey on sides (Italy)..... *S. v. italicus*, p. 912.
Winter pelage of red phase strongly suffused with grey on sides.
Red in both winter and summer, clear bright rufous (East-central Europe)..... *S. v. fuscoater*, p 910.
Red in both winter and summer, rufous strongly tinged with chestnut (West-central Europe)..... *S. v. russus*, p. 909.

Sciurus vulgaris vulgaris Linnæus.

1758. [*Sciurus*] *vulgaris* Linnæus, Syst. Nat., I, 10th ed., p. 63.
1792. *Sc[iurus] vulg[aris] rufus* Kerr, Anim. Kingd., p. 255 (Renaming of *vulgaris*).
1827. *Sciurus vulgaris β. albo notatus* Billberg, Synopsis Faunæ Scandinaviæ, p. 2 (Southern Sweden).
1827. *Sciurus vulgaris γ. albus* Billberg, Synopsis Faunæ Scandinaviæ, p. 2 (Skåne, Sweden).
1827. *Sciurus vulgaris δ. niger* Billberg, Synopsis Faunæ Scandinaviæ, p. 2 (Skåne, Sweden).
1857. *Sciurus vulgaris* Blasius, Säugethiere Deutschlands, p. 272 (part).
1899. *Sciurus vulgaris typicus* Barrett-Hamilton, Proc. Zool. Soc., London, p. 6.
1910. *Sciurus vulgaris* Trouessart, Faune Mamm. d'Europe, p. 117.

Type locality. Upsala, Sweden.

Geographical distribution.—Scandinavian peninsula except extreme northern portion. Exact northern limit of range not known.

Diagnosis.—True dark brown phase absent or extremely rare, though tail often considerably blackened. Summer pelage: body dark rufous tinged with chestnut; tail clear dark rufous. Winter pelage: body grizzled smoke-grey strongly tinged with chestnut along middle of back; tail rufous chestnut.

Measurements.—Average and extremes of eight adults from the type locality: head and body, 209·7 (203–215); tail, 178·7 (172–189); hind foot, 59·1 (58–60). For cranial measurements see Table, p. 918.

Specimens examined.—Fifty-three, from the following localities:—
Norway: Tolgen, Hedemarken, 1; Foldalen, Hedemarken, 1; Gausdal, Kristiansamt, 1; Sundal, Bergenhus, 2; Konnerud, Buskerud, 1; Spjotsod, Telemarken, 3 (U.S.N.M.); Aas, Akershus, 2; Aker, Akershus, 12 (B.M. and U.S.N.M.); Asker, Christiania, 2 (B.M. and U.S.N.M.); Maersness, Christiania, 1; Holmestrand, Jarlesberg, 1; Kristiansand, Mandal, 2; Frederickshold, Smaalenene, 2; Gudbrandsdal, 1; no exact locality, 4.
Sweden: Upland, 2, near Upsala, 15 (B.M. and U.S.N.M.).

♀.	Tolgen, Hedemarken, Norway.	Christiania Museum (E). 97. 3. 13. 12.
?.	Foldalen, Hedemarken.	Christiania Museum (E). 97. 3. 13. 13.
♂.	Gausdal, Kristiansamt.	Christiania Museum (E). 97. 3. 13. 14.
♂, ♀, 2.	Sundal, Bergenhus.	C. B. Horsburgh (C & P). 99. 9. 5. 1–2.
♂.	Konnerud, Buskerud.	Christiania Museum (E). 97. 3. 13. 21.
2 ♂.	Aas, Akershus.	Christiania Museum (E). 97. 3. 13. 17–18.
♂.	Aker, Akershus.	Christiania Museum (E). 93. 3. 11. 8.
7 ♂, 2 ♀, 2 juv.	Aker, Akershus.	Christiania Museum (E). 97. 3. 13. 1–11.
♀.	Christiania Fjord.	Rev. H. H. Slater (C & P). 99. 11. 27. 5.
♂.	Holmestrand, Jarlesberg.	Christiania Museum (E). 97. 3. 13. 22.
2.	Kristiansand, Mandal.	Christiania Museum (E). 97. 3. 13. 15–16.
2.	Frederikshold, Smaalenene.	Christiania Museum (E). 97. 3. 13. 19–20.
♂.	Gudbrandsdal. (*J. L. Lanholte.*)	G. Barrett-Hamilton (P). 11. 1. 2. 151.

2 ♂, 2 ♀.	Near Christiania.	W. E. de Winton (c & p).	97. 4. 11. 1–4.
♂ juv., ♀.	Upland, Sweden. (*G. Kolthoff.*)	Lord Lilford (p).	11. 1. 1. 48–49.
2 ♂.	Upsala. (*G. Kolthoff.*)	Lord Lilford (p).	11. 1. 1. 50–51.

Sciurus vulgaris varius Gmelin.

1789. [*Sciurus vulgaris*] β *varius* Gmelin, Syst. Nat., I, 13th ed., p. 146.
1792. *Sc*[*iurus*] *vulg*[*aris*] *varius* Kerr, Anim. Kingd., p. 256.
1829. *Sciurus vulgaris* β *cinereus* Fischer, Synopsis Mammalium, p. 353. Not *Sciurus cinereus* Linnæus.
1857. *Sciurus vulgaris* Blasius, Saugethiere Deutschlands, p. 272 (part).
1899. *Sciurus vulgaris varius* Barrett-Hamilton, Proc. Zool. Soc., London, p. 6.
1906. *Sciurus vulgaris varius* Trouessart, Bull. Mus. d'Hist. Nat. Paris, XII, p. 360.
1910. *Sciurus vulgaris varius* Trouessart, Faune Mamm. d'Europe, p. 117.

Type locality. Northern Europe.

Geographical distribution. From the extreme north of Scandinavia eastward across Finland and into Russia.

Diagnosis. Similar to *Sciurus vulgaris vulgaris* but with grey of winter pelage much lighter, closely approaching the pearl-grey of Ridgway, and median dorsal region scarcely if at all washed with chestnut.

Colour.—Winter pelage: hairs of upper parts slate grey at base (10 mm.), the underfur tipped (4 mm.) with a pale grey most nearly approaching the grey No. 10 of Ridgway, but less blue and with a slight smoky cast, the longer hairs (30 mm.) greyish to level of tips of underfur, then light hair-brown with from one to three whitish annulations. The general effect is a delicately grizzled, light bluish grey, approaching the pearl-grey of Ridgway, the sides lighter and clearer; the back with a slight drab cast. In some specimens the drab becomes faintly reddish. Crown and face not so pale as back, occasionally with a distinct brownish or reddish wash. Cheeks like sides of body; muzzle buffy whitish. Ears grizzled grey like sides of body internally, the tufts varying from orange-rufous to blackish. Outer surface of legs like sides of body, usually tinged to a varying degree with dull orange-rufous or light russet, this generally the dominant colour on upper side of feet; soles light buffy grey. Tail greyish or light reddish russet above, clouded by the blackish sub-terminal bands (20 mm.) of hairs; tips of hairs inconspicuously light russet. Underside of tail with median area (25 mm.) like sides of body but more coarsely grizzled, this edged with yellowish russet (10 mm.) and blackish. Underparts and inner surface of legs creamy white to base of hairs; chin sometimes a little grizzled with grey.

Measurements. Adult male from Kirkkonummi, Finland: head and body, 205; tail, 160; hind foot, 55; ear, 30. For cranial measurements see Table, p. 918.

Specimens examined.—Eight, from the following localities:—
NORWAY: Hammerfest, Finmarken, 2; Alten, Finmarken, 1.
SWEDEN: Enontekis, Norrbotten, 1.
FINLAND: Muonionniska, 3; Kirkkonummi, 1.

2.	Hammerfest, Finmarken, Norway. (*J. L. Bonhote.*)	G. Barrett-Hamilton (P).	11. 1. 2. 152–153.
♀.	Alten, Finmarken.	Christiania Museum (P).	93. 3. 1. 9.
♂.	Enontekis, Norrbotten, Sweden.	D. Meinertzhagen (C & P).	97. 10. 21. 5.
4.	Muonionniska, Finland.	D. Meinertzhagen (C & P).	97. 10. 21. 1–4.
♂.	Kirkkonummi, Finland. (*P. Merilainen.*)	Lord Lilford (P).	98. 11. 4. 2.

SCIURUS VULGARIS LEUCOURUS Kerr.

1792. *Sc[iurus] vulg[aris] leucourus* Kerr, Anim. Kingd., p. 256.
1857. *Sciurus vulgaris* Blasius, Säugethiere Deutschlands, p. 272 (part).
1896. *Sciurus vulgaris leucurus* Thomas, The Zoologist, 3d ser., XX, p. 402, November, 1896.
1899. *Sciurus leucurus* Barrett-Hamilton, Proc. Zool. Soc., London, p. 3.
1906. *Sciurus vulgaris leucurus* Trouessart, Bull. Mus. d'Hist. Nat., Paris, XII, p. 362.
1910. *Sciurus vulgaris leucurus* Trouessart, Faune Mamm. d'Europe, p. 118.

Type locality.—England.

Geographical distribution.—Great Britain and Ireland.

Diagnosis.—Dark phase absent; tail drab, fading in summer to cream-buff, never tinged with red; summer pelage: general colour above light hazel or dull rufous, clearest and brightest on sides and legs; winter pelage: general colour above a dull broccoli-brown. Size small, the condylobasal length of skull rarely if ever exceeding 48 mm.

Colour.—Summer pelage: upper parts a reddish brown varying from a light hazel to a dull rufous, darker and less reddish along median area from face to rump, brighter on sides, on outer surface of limbs, and on feet; underparts dull white, usually marked off from brown of sides by a narrow line of tawny-ochraceous, this spreading to suffuse inner surface of limbs; tail a rather dark drab bleaching irregularly to cream-buff; a similar bleaching takes place in the remnants of the ear-tufts which occasionally persist. Winter pelage: upperparts an inconspicuously grizzled greyish brown approaching the broccoli-brown of Ridgway; the middle of back faintly darker, the shoulders and sides of neck usually tinged with russet; outer surface of limbs and narrow line along sides russet or hazel, rarely with the decided reddish tinge seen in summer; underparts dull white; tail and ear-tufts drab, occasionally with a dusky cast.

Measurements.—Adult male and female from Dunphail, Elgin, Scotland: head and body, 218 and 213; tail, 179 and 165;

hind foot, 58 and 56. Average and extremes of ten adults from Saffron Walden, Essex: head and body, 227·5 (220–238); tail, 171·9 (159–178); hind foot, 56·0 (55–58). Average and extremes of ten adults from Blandford, Dorset: head and body, 216·4 (211–224); tail, 172·1 (162–190); hind foot, 57·0 (55–59); ear, 27·7 (27–29). For cranial measurements see Table, p. 919.

Specimens examined. One hundred and seventy-four, from the following localities:—

Ireland: Craigie, Kilmanock, 1; Ahascragh, Galway, 1; Woodpark, Clare, 1; Graigne, Kilkenny, 1.

Scotland: Black Isle, Cromarty, 1; Dunphail, Elgin, 3; Ballendsloch, Banffshire, 2; Loch Earn Head, Perthshire, 3; Pitlochry, Perthshire, 2; Stockbriggs, Lanarkshire, 3; Tillicoultry, Clackmannanshire, 3.

England: Guisborough, Yorkshire, 2; Leeds, Yorkshire, 2 (U.S.N.M.); Oswaldskirk, Yorkshire, 1; Greta Bridge, Yorkshire, 1; Cowfold, Horsham, Norfolk, 1; Bury St. Edmunds, Suffolk, 3; Barrow, Suffolk, 3 (U.S.N.M.); Cambridge, 1; Graftonbury, Herefordshire, 4; Dudley, Worcestershire, 1; Middlehill, Broadway, Worcestershire, 4; Chipping, Sodbury, Gloucestershire, 1; Newland, Coleford, Gloucestershire, 1; Clarberton Road, Pembrokeshire, 1; Glamorganshire, 1; Monmouthshire, 1; Clevedon, Somersetshire, 1; Wormsley, Oxfordshire, 5; Thornhaugh, Northamptonshire, 4; Luton, Bedfordshire, 6; Felden, Hertfordshire, 3; Tring, Hertfordshire, 1; Saffron Walden, Essex, 40; Whitley, Surrey, 1 (U.S.N.M.); Milford, Surrey, 2 (U.S.N.M.); Horsham, Surrey, 1; Knockholt, Kent, 5; Upton, near Andover, Hampshire, 1; Blandford, Dorsetshire, 55.

Remarks.—By its small size and the peculiar colour of its tail the British squirrel is one of the most sharply differentiated races of *Sciurus vulgaris*. Nothing like the peculiar summer whitening of the tail occurs in the other forms; and this character is the more remarkable for its occurrence in an animal subjected to climatic conditions the reverse of those which would be expected to produce bleaching. Even when not bleached the tail is of a drab hue unlike that in any of the Continental forms. It would probably be more logical to regard the animal as a distinct species, but for convenience it is here treated as a race.

♀.	Ahascragh, Galway, Ireland. (*W. S. Witherby.*)	G. Barrett-Hamilton (P).	11. 1. 2. 154.
♂.	Woodpark, Clare. (*R. F. Hibbert.*)	G. Barrett-Hamilton (P).	11. 1. 2. 155.
♀.	Graigne, Kilkenny. (*L. I. Finn.*)	G. Barrett-Hamilton (P).	11. 1. 2. 156.
♀.	Black Isle, Cromarty, Scotland.	W. R. Ogilvie-Grant (C & P).	11. 1. 3. 422.
♀.	Dunphail, Elgin.	W. R. Ogilvie-Grant (C & P).	11. 1. 3. 423.
3 ♂.	Stockbriggs, Lanarkshire.	E. R. Alston (C & P).	79. 9. 25. 26–28.
♂,2♀.	Tillicoultry, Clackmannanshire.	R. G. Wardlaw Ramsay (C & P).	11. 1. 3. 424–426.
1.	Glamorganshire, Wales.	Rev. A. Morgan (C & P).	71. 7. 9. 1.
1.	Monmouthshire.	Rev. A. Morgan (C & P).	73. 7. 12. 1.
♂.	Oswaldskirk, Yorkshire, England.	A. Houston Boswell (C & P).	11. 1. 3. 427.
♀.	Guisborough, Yorkshire.	A. E. Pease (C & P).	11. 1. 3. 428.

♂, 2♀.	Thornhaugh, Northamptonshire.	Rev. H. H. Slater (c & p).	11. 1. 3. 429–431.
2 ♂.	Bury St. Edmunds, Suffolk.	Dr. A. Günther (c & p).	83. 2. 3. 1–2.
♂.	Horsham, Surrey. (*J. E. Harting.*)	E. R. Alston (p).	79. 9. 25. 29.
55.	Blandford, Dorset.	J. C. Mansel Pleydell (c & p).	97. 1. 6. 1–55.

Sciurus vulgaris russus Miller.

1857. *Sciurus vulgaris* Blasius, Säugethiere Deutschlands, p. 272 (part).
1899. *Sciurus vulgaris rufus* Barrett-Hamilton, Proc. Zool. Soc., London, p. 5 (part). Not of Kerr, 1792.
1906. *Sciurus vulgaris rufus* Trouessart, Bull. Mus. d'Hist. Nat. Paris, xii, p. 360 (part). Not of Kerr, 1792.
1907. *Sciurus vulgaris russus* Miller, Ann. and Mag. Nat. Hist., 7th ser., xx, p. 427, November, 1907. Type in British Museum.
1910. *Sciurus vulgaris russus* Trouessart, Faune Mamm. d'Europe, p. 119.

Type locality.—Dinan, Côtes-du-Nord, France.

Geographical distribution.—West-central continental Europe from Brittany to Holland, east to central France and perhaps further; details of distribution not known.

Diagnosis.—Dark phase present but less common than red phase. Summer pelage: red phase: essentially as in *S. vulgaris vulgaris*, but red of back more strongly tinged with chestnut; dark phase: body very dark, almost blackish mummy-brown, the sides and shoulders washed with hazel; tail blackish. Winter pelage: light phase: body hazel, the sides a little suffused with light smoke-grey, tail rufous, much darker than that of Ridgway; dark phase not seen.

Measurements.—Type (adult male): head and body, 202; tail, 166; hind foot, 54; ear, 30. A second adult male from the type locality: head and body, 208; tail, 173; hind foot, 54; ear, 28. Adult male and female from Oosterbeek, Guelderland, Holland: head and body, 217 and 227; tail, 175 and 172; hind foot, 57·5 and 57·5; ear, 31 and 32. For cranial measurements see Table, p. 919.

Specimens examined.—Twenty-six, from the following localities:—
Holland: s'Graveland, 8; Oosterbeek, Guelderland, 2.
France: Seine-Inférieure, 5; Dinan, Côtes-du-Nord, 4; Meurthe-et-Moselle, 7 (perhaps referable to *S. v. infuscatus*).

2 ♂, 4 ♀.	s'Graveland, Hilversen, Holland.	F. E. Blaauw (c & p).	98. 5. 17. 1–2. 98. 6. 11. 1–2. 98. 11. 13. 1–2.
♂, ♀.	Oosterbeek, Guelderland.	O. Thomas (c & p).	98. 2. 1. 13–14.
♂.	Duclair, Seine-Inférieure, France.	G. Barrett-Hamilton (p).	11. 1. 2. 157.
4 ♂.	Dinan, Brittany.	W. J. Bramley (c & p).	97. 11. 6. 1–4. (97. 11. 6. 2. *Type* of subspecies.)
5 ♀.	Manonville, Meurthe-et-Moselle. (*Lomont.*)	Lord Lilford (p).	11. 1. 1. 97–101.

Sciurus vulgaris fuscoater Altum.

1894. *Sciurus vulgaris* var. *cinerea* Hermann, Observ. Zool., p. 65 (Germany?) Not *Sciurus cinereus* Linnæus 1766.
1857. *Sciurus vulgaris* Blasius Säugethiere Deutschlands, p. 272 (part).
1876. [*Sciurus vulgaris*] var. *fuscoatra* Altum, Forstzoologie, 2d ed., I, p. 75 (Harz Mts. and Silesia).
1876. [*Sciurus vulgaris*] var. *nigrescens* Altum, Forstzoologie, 2d ed., I, p. 75 (Silesia).
1876. [*Sciurus vulgaris*] var. *brunnea* Altum, Forstzoologie, 2d ed., I, p. 75 (Alsace-Lorraine).
1876. [*Sciurus vulgaris*] *grisea* Altum, Forstzoologie, 2d ed., I, p. 75 (synonym of *brunnea*).
1876. [*Sciurus vulgaris*] *alpina* Altum, Forstzoologie, 2d ed., I, p. 75 (synonym of *brunnea*). Not *Sciurus alpinus* F. Cuvier, 1842.
1899. *Sciurus vulgaris rufus* Barrett-Hamilton, Proc. Zool. Soc. London, p. 5. Not of Kerr, 1792.
1905. *Sciurus vulgaris* var. *gotthardi* Fatio, Arch. Sci. Phys. et Nat., Genève, 4th ser., XIX, p. 512 (South slope of Mt. St. Gothard, Switzerland).
1907. *Sciurus vulgaris rutilans* Miller, Ann. and Mag. Nat. Hist., 7th ser., XX, p. 426, November, 1907 (Rudolstadt, Thüringen, Germany). Type in British Museum.
1908. *Sciurus vulgaris fuscoater* Miller, Ann. and Mag. Nat. Hist., 8th ser., I, p. 128, January, 1908.
1910. *Sciurus vulgaris fuscoater* Trouessart, Faune Mamm. d'Europe, p. 118.

Type locality. Harz Mountains, Germany.

Geographical distribution. East central Europe from Germany through Austria Hungary to Roumania; south through the Alps.

Diagnosis. Similar to *S. vulgaris russus*, but red phase in both winter and summer a clear bright rufous, tinged with grey on sides and sometimes on back. Dark phase present but less common than red phase, the relative abundance of the two subject to much local variation. Summer pelage: light phase: body clear rufous, closely agreeing with that of Ridgway, and without chestnut suffusion, tail the same clear rufous but more intense; dark phase as in winter but general effect more sooty. Winter pelage: light phase: body rufous tinged with light smoke-grey along sides, tail clear rufous; dark phase: body a grizzled hair-brown suffused with mummy brown over back: tail slaty black.

Measurements.—Average and extremes of five adults from Ingelheim, Rheinhessen, Germany: head and body, 229·4 (220–236); tail, 192 (189–198); hind foot, 60·4 (59–61); ear, 32·4 (31–34). Young adult male from Rudolstadt, Thüringen, Germany (type of *rutilans* Miller): head and body, 223; tail, 175; hind foot, 57; ear, 27. Adult female from Niesky, Silesia, Germany: head and body, 228; tail, 195; hind foot, 62; ear, 32. Adult male and female from St. Gallen, Switzerland: head and body, 230 and 229; tail, 184 and 190; hind foot, 61 and

59. Adult male from Hatszeg, Hunyad, Hungary: head and body, 220; tail, 190; hind foot, 59. Average and extremes of five adults from Bustenari, Roumania: head and body, 220·8 (213–225); tail, 181·2 (170–185); hind foot, 58·6 (57–60); ear, 30·9 (29–32·5). For cranial measurements see Table, p. 920.

Specimens examined. –One hundred and seventy, from the following localities:—

France: Étupes, Doubs, 1 (Mottaz); Montauban, Haute-Savoie, 2; Les Pitons, Haute-Savoie, 11 (Mottaz); Scientriers, Haute-Savoie, 2 (Mottaz); Barcelonnette, Basses-Alpes, 5 (B.M. and Mottaz); Digne, Basses-Alpes, 3 (Mottaz).

Germany: Marburg, Hessen-Nassau, 4; Blumenthal, Hanover, 2; Buchholz, Saxony, 1 (U.S.N.M.); Moritzburg, Saxony, 2 (U.S.N.M.); Wernigerode, Saxony, 1; Neustadt, Saxony, 2; Ilsenburg, 9; Magdeburg, 1; Ammenslablen, 1; Rudolstadt, Thüringen, 5; Ummerstadt, Thüringen, 12; Ingelheim, 10; Hartwald, Baden, 1 (U.S.N.M.); Nuremberg, Bavaria, 1 (U.S.N.M.); Strass, near Burgheim, Bavaria, 9; Marxheim, near Monheim, Bavaria, 6; Niesky, Silesia, 1.

Austria-Hungary: Csallóköz-Somorja, Pressburg, 2; Trefail, Steiermark, 1; Haida, Arva, Bohemia, 6; Karlsbad, Bohemia, 1; Hatszeg, Hunyad, Bohemia, 1; Hungary, no exact locality, 1 (U.S.N.M.); Zuberec Hungary, 2.

Roumania: Bustenari, Prahova, 5.

Switzerland: Geneva, 2 (Mottaz); St. Cergues, Vaud, 1 (U.S.N.M.); Morat, Fribourg, 1 (Mottaz); St. Gallen, 5 (B.M. and U.S.N.M.); Gais, Appenzell, 1 (U.S.N.M.); Herisau, Appenzell, 1 (U.S.N.M.); Untervatz, Grisons, 3 (B.M. and U.S.N.M.); Rabius, Grisons, 1 (U.S.N.M.); Albogasio, Ticino, 1 (U.S.N.M.); Curregia, Ticino, 1 (U.S.N.M.); Davesco, near Lugano, Ticino, 2; Lugano, Ticino, 6 (Mottaz); Lumino, Ticino, 1 (U.S.N.M.); no exact locality, 1.

Italy: Padola, Cadore, 4 (Turin); Crevacuore, Novara, 3 (Turin); Coggiola, Novara, 7 (Turin); Val d'Aosta, 3 (Turin); near Turin, 2 (Turin); Sommariva del Bosco, Cuneo, 2 (Turin); Dronero, Cuneo, 1.

1.	Montauban, Haute-Savoie, France.	A. Robert (c & p).	97. 1. 9. 4.
♂.	Montauban, Haute-Savoie. (*A. Robert.*)	O. Thomas (p).	6. 4. 2. 9.
♂, 2 ♀.	Marburg, Hessen-Nassau, Germany. (*Schneider.*)	Lord Lilford (p).	11. 1. 1. 76–78.
♂.	Blumenthal, Hanover. (*Wolterstorff.*)	Lord Lilford (p).	11. 1. 1. 87.
♀.	Wernigerode, Saxony. (*Wolterstorff.*)	Lord Lilford (p).	11. 1. 1. 88.
♂, ♀.	Neustadt, Saxony. (*Schneider.*)	Lord Lilford (p).	11. 1. 1. 83–84.
♂, ♀ ♀.	Ilsenburg, Saxony. (*Bartells.*)	Lord Lilford (p).	11. 1. 1. 52–60.
1.	Gross Ammenslablen, Saxony. (*Schuchardt.*)	Lord Lilford (p).	11. 1. 1. 91.
♂.	Magdeburg, Saxony.	Lord Lilford (p).	7. 9. 7. 1.
5 ♂, ♀.	Ummerstadt, Thüringen. (*Schuchardt.*)	Lord Lilford (p).	11. 1. 1. 70–75.
2 ♂, 3 ♀.	Rudolstadt, Schwartzburg, Thüringen.	Lord Lilford (p).	95. 4. 18. 7–11. (95.4.18.7. *Type* of *S. v. rutilans* Miller.)
♂, 5 ♀.	Ingelheim, Rheinhessen.	C. Hilgert (c).	8. 11. 2. 32–37.
3 ♂, ♀.	Ingelheim, Rheinhessen. (*Hilgert.*)	Lord Lilford (p).	11. 1. 1. 79–82.
♀, 1.	Burgheim, Bavaria. (*Körbitz.*)	Lord Lilford (p).	11. 1. 1. 85–86.

♀.	Strass, Bavaria.	Lord Lilford (P).	11. 1. 1. 89.
♂, 2 ♀.	Marxheim, Bavaria. (*Wolterstorff.*)	Lord Lilford (P).	11. 1. 1. 67–69.
♀.	Niesky, Silesia.	Dr. E. Hamilton (P).	97. 12. 4. 20.
2.	Csallóköz-Somorja, Pressburg, Hungary.	Budapest Museum (E).	94. 3. 1. 29.
♂.	Trefail, Steiermark, Hungary.	Lord Lilford (P).	11. 1. 1. 90.
6 ♂.	Haida, Bohemia. (*Wolterstorff.*)	Lord Lilford (P).	11. 1. 1. 61–66.
1.	Karlsbad, Bohemia.	Lord Odo Russell (C & P).	44. 9. 7. 3.
♂.	Hatszeg, Hunyad, Transylvania.	C. G. Danford (C).	3. 11. 8. 20.
2.	Zubereč.	Budapest Museum (E).	94. 3. 1. 31–32.
3 ♂, 2 ♀.	Bustenari, Prahova, Roumania. (*W. Dodson.*)	Lord Lilford (P).	4. 4. 6. 67–71.
2 ♂, 2 ♀.	St. Gallen, Switzerland. (*Zollikofer.*)	O. Thomas (P).	4. 4. 5. 35–38.
2 ♀.	Untervatz, Grisons. (*Zollikofer.*)	O. Thomas (P).	4. 4. 5. 39–40.
♂, ♂ juv.	Davesco, Ticino. (*Zollikofer.*)	O. Thomas (P).	2. 8. 4. 28–29.
♂.	Switzerland.	E. R. Alston (P).	79. 9. 25. 30.

Sciurus vulgaris italicus Bonaparte.

1838. *Sciurus italicus* Bonaparte, Iconogr. Faun. Ital., I, fasc. 23 (Italy).
1857. *Sciurus vulgaris* Blasius, Säugethiere Deutschlands, p. 272 (part).
1906. *Sciurus vulgaris italicus* Trouessart, Bull. Mus. d'Hist. Nat. Paris, XII, p. 364 (part).
1907. *Sciurus meridionalis* Lucifero, Revista Ital. di Sci. Nat., Siena, XXVI, p. 45, June, 1907 (Sila, Calabria, Italy). Renaming of *S. alpinus* Costa (not of Desmarest).
1910. *Sciurus vulgaris italicus* Trouessart, Faune Mamm. d'Europe, p. 122.

Type locality.—Italy.

Geographical distribution.—Italy except the region north of the Apennines.

Diagnosis.—Red phase lighter and more ochraceous than in *Sciurus vulgaris fuscoater;* brown phase less dark than in *fuscoater*, the tail with broad grizzled median area; back rarely if ever showing any evident trace of a darker median line, and sides rarely with any noticeable greyish suffusion even in winter.

Colour.—Red phase, winter: upper parts clear ochraceous-rufous, the crown, ears and median dorsal region brighter and more red, the sides paler and duller but with no distinct intermixture of grizzled grey; tail dark orange-rufous, the median region below tinged with light clay-colour or occasionally somewhat grizzled; feet like median region of back, the soles drab; face and muzzle, especially the region surrounding base of whiskers, fading to ochraceous-buff; underparts from throat to base of tail buffy white; interramia tinged with grey; inner side of legs paler and less red than outer side, closely resembling

median region of tail. Brown phase, winter: back and sides a uniform, rather fine grizzle of wood-brown, cream-buff and black, in which the brown predominates, and in which there is frequently a decided tinge of drab; ear tufts dark brown, approaching black, some of the hairs usually with indistinct light annulations; tail blackish brown above, the underside with a broad median band essentially like back except that it is much more coarsely grizzled; feet varying from dull russet to blackish, the soles usually hair-brown or drab; muzzle dull ochraceous-buff; underparts as in red phase except that interramial region is darker and often with a slaty tinge. Summer pelage not seen.

Measurements.—Average and extremes of five adults from western Liguria, Italy: head and body, 230 (218–242); tail, 188·2 (176–197); hind foot, 58 (57–60); ear, 29·4 (27–31). Average and extremes of four adults from the province of Rome, Italy: head and body, 237·7 (220–250); tail, 196·2 (192–200); hind foot, 58·5 (57–60). For cranial measurements see Table, p. 921.

Specimens examined.—Thirty-eight, from the following localities in Italy: neighbourhood of Genoa, 28 (Genoa); Spezia, 1 (Turin); Quiesa, Lucca, 1; San Casciano, Florence, 2; Siena, 2; Arsoli, Rome, 2; Viterbo, Rome, 2.

♂.	Quiesa, Lucca, Italy.	Dr. E. Hamilton (P).	98. 10. 2. 9.
♂.	San Casciano, Florence.	Dr. E. Hamilton (P).	98. 10. 2. 10.
2.	Siena. (*Brogi.*)	Paris Museum (E).	6. 7. 15. 1–2.
♀.	Arsoli, Rome. (*Coli.*)	G. Barrett-Hamilton (P).	11. 1. 2. 36.
♂.	Viterbo, Rome. (*Coli.*)	G. Barrett-Hamilton (P).	11. 1. 2. 35.

SCIURUS VULGARIS LILÆUS Miller.

1906. *Sciurus vulgaris italicus* Trouessart, Bull. Mus. d'Hist. Nat. Paris, XII, p. 364 (part).

1907. *Sciurus vulgaris lilæus* Miller, Ann. and Mag. Nat. Hist., 7th ser., XX, p. 429, November, 1907. Type in British Museum.

1910. *Sciurus vulgaris lilæus* Trouessart, Faune Mamm. d'Europe, p. 123.

Type locality.—Agoriani, north side of Lyakura (Parnassus) Mountains, Greece.

Geographical distribution.—Greece; limits of range not known.

Diagnosis.—Size as in *S. vulgaris italicus;* colour in brown phase peculiar in the noticeable contrast of the very dark, almost blackish, posterior half of back with the hair-brown shoulders and neck; red phase not known and probably rare or absent.

Colour.—General colour above a grizzled hair-brown, paler and more grey on cheeks and across muzzle, much darkened with blackish on posterior half of back and on outer surface of hind legs. Inner surface of hind legs and line along sides of body bordering white of underparts tawny-ochraceous, becoming

lighter and duller anteriorly and continuing over outer surface of fore leg and along side of neck. Feet dull tawny-ochraceous clouded with blackish. Tail blackish suffused with tawny-ochraceous beneath surface. Underparts creamy white; chin and interramial region light drabby grey.

Measurements.—Type (young adult female): hind foot, 60; ear from meastus, 29. For cranial measurements see Table, p. 921.

Specimens examined.—Three, all from the type locality.

1. Agoriani, Lyakura Mts., Greece. (*Schlüter.*) Lord Lilford (P). 7. 9. 8. 1. (*Type* of subspecies.)
1. Parnassus. Lord Lilford (P). 8. 10. 17. 1.

Sciurus vulgaris alpinus Desmarest.

1822. *Sciurus alpinus* Desmarest, Mammalogie, II, p. 543 (Pyrenees).
1842. *Sciurus alpinus* F. Cuvier, Hist. Nat. des Mamm., IV, tabl. gen., p. 4 (described and figured in fasc. 24, pl. 237, 1821).
1857. *Sciurus vulgaris* Blasius, Säugethiere Deutschlands, p. 272 (part).
1905. *Sciurus alpinus* Cabrera, Bol. Real Soc. Españ. Hist. Nat., V, p. 230, April, 1905.
1906. *Sciurus vulgaris alpinus* Trouessart, Bull. Mus. d'Hist. Nat., Paris, XII, p. 363.
1910. *Sciurus vulgaris alpinus* Trouessart, Faune Mamm. d'Europe, p. 119.

Type locality.—Pyrenees.

Geographical distribution.—Pyrenees; limits of range not known.

Diagnosis.—Size essentially as in *Sciurus vulgaris italicus*; colour in dark phase similar to that of *S. v. russus* and *S. v. fuscoater*; skull with rostral portion noticeably broadened and shortened.

Measurements. Adult male from Espot, Lérida, Spain: head and body, 240; tail, 205; hind foot, 58; ear, 22. For cranial measurements, see Table, p. 921.

Specimens examined.—Two from Espot, Lérida, Spain (U.S.N.M. and Cabrera).

Remarks.—The status of this race is not clearly understood.

Sciurus vulgaris numantius Miller.

1905. *S[ciurus]* sp. Cabrera, Bol. Real Soc. Españ. Hist. Nat., Madrid, IV, pp. 224, 231, April, 1905.
1905. *S[ciurus] rufus* Cabrera, Bol. Real Soc. Españ. Hist. Nat., Madrid, IV, p. 225, April, 1905 (not of Kerr, 1792).
1907. *Sciurus vulgaris numantius* Miller, Ann. and Mag. Nat. Hist., 7th ser., XX, p. 428, November, 1907. Type in British Museum.
1910. *Sciurus vulgaris numantius* Trouessart, Faune Mamm. d'Europe, p. 120.

Type locality.—Pinares de Quintanar de la Sierra, Burgos, Spain.

Geographical distribution.—Northern and north-central Spain (provinces of Leon, Vitoria, Huesca and Burgos); limits of range not known.

Diagnosis.—Size greater than in the central European forms, nearly equal to that of *S. v. infuscatus*; colour in light phase not so dark as in *S. v. infuscatus*, and tail never with whitish median area on lower surface.

Colour.—Light phase (type): head, back, sides, and outer surface of legs a uniform indistinctly grizzled brown, intermediate between the broccoli-brown and wood-brown of Ridgway; a faint russet tinge along middle of back. Muzzle and fore part of face between ochraceous-buff and clay-colour. Cheeks drab. Ear-tufts blackish brown, sides of neck pale dull wood-brown. Inner surface of legs and ill-defined stripe along sides of belly dull light hazel. Feet like inner side of legs, but paler. Tail a very dark rufous, approaching the chestnut of Ridgway, especially near base, but rather more red; median portion of tail below lighter, the hairs buffy grey through basal half, each with two drab annulations. Underparts buffy white, the chin and interramial region light ecru-drab. Dark phase: tail clear bluish black, very faintly grizzled along median region below; back much darkened by a blackish suffusion. Colour variation shows itself chiefly in a greater or less tendency to assume the dark phase. Occasionally the hazel of sides brightens almost to a dull rufous and spreads to lateral portion of dorsal area, the region immediately bordering white of ventral surface becoming nearly buff. Ear-tufts either blackish or reddish.

Skull and teeth.—The skull and teeth are larger than those of the central European races, but in form they show no tangible peculiarities.

Measurements.—Type (adult female): head and body, 237; tail, 200; * hind foot, 66; ear, 34. Two other adult females from the type locality: head and body, 235 and 250; tail, 190 and 210; hind foot, 63 and 64; ear, 34 and 34. Adult male from Panticosa, Huesca: head and body, 262; tail, 242; hind foot, 64; ear, 36. For cranial measurements see Table, p. 922.

Specimens examined.—Twenty-two, from the following localities:—
France: Solférino, Landes, 1; St. Jean de Luz, Basses-Pyrénées, 1. (These specimens intermediate between *numantius* and *russus*.)
Spain: Sierra de Dubros, Asturias, 2; Pajáres, Leon, 1; Arrechavaleta, Vitoria, 2; Panticosa, Huesca, 6; Palacios de la Sierra, Burgos, 2 (U.S.N.M.); Pinares de Quintanar, Burgos, 7.

♀.	Solférino, Landes, France. (*A. Robert.*)	O. Thomas (P).	6. 4. 1. 38.
♂.	St. Jean de Luz, Basses-Pyrénées.	W. Eagle Clarke (P).	92. 10. 30. 1.
♂, ♀.	Sierra de Dubros, Asturias, Spain.	J. W. Richmond Lee (C & P).	97. 1. 7. 1 2.

* Misprinted 230 in original description.

♀.	Pajáres, Leon. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 61.
2 ♂.	Arrechavaleta, Vitoria. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 65–66.
2 ♂, ♀.	Panticosa, Huesca. (*N. Gonzalez.*)	O. Thomas (P).	8. 2. 9. 62–64.
5 ♀.	Pinares de Quintanar, Burgos.	G. S. Miller (C). (8. 8. 4. 52.	8. 8. 4. 52–56. *Type* of subspecies.)

Sciurus vulgaris infuscatus Cabrera.

1905. *Sciurus infuscatus* Cabrera, Bol. Real Soc. Españ. Hist. Nat., v, p. 227, April, 1907. Type in U.S. National Museum.
1909. *Sciurus vulgaris infuscatus* Miller, Ann. and Mag. Nat. Hist., 8th ser., III, p. 418, May, 1908.
1910. *Sciurus vulgaris infuscatus* Trouessart, Faune Mamm. d'Europe, p. 121.

Type locality.—Las Navas, Avila, Spain.

Geographical distribution.—Central Spain.

Diagnosis.—Largest of the European squirrels (condylobasal length of skull, 52·4 to 55 mm.); colour very dark, the two phases if present not well defined; tail rusty red, its under surface conspicuously sprinkled with pure white hairs; cheeks and throat strongly contrasted in colour.

Colour.—Upper parts a rich, faintly grizzled dark brown, the general effect nearly the mummy-brown of Ridgway, the posterior half of back darker and less grizzled than shoulders and neck; underfur slate-grey, the tips of the hairs russet; face rather abruptly russet, the muzzle tinged with buff; cheeks below and behind eyes an indefinite drab brown, noticeably contrasted with surrounding parts, especially with white of throat; ears russet, the longer hairs dusky; feet rufous, somewhat darker than that of Ridgway, this colour suffusing outer surface of fore leg and extending up inner surface of hind leg to thigh, though in both instances duller and more brownish on leg than on foot; underparts buffy white, the extreme bases of hairs inconspicuously greyish, the white covering entire inner side of fore leg to wrist, and extending as a narrow line down inner side of hind leg to heel and sole; tail a rich dark red, between the rufous and ferruginous of Ridgway, the distal half usually with a slight dusky cast, the entire tail sprinkled with pure white hairs, this inconspicuous above but tending to form a whitish, often very noticeable median area below.

Skull and teeth.—Except for their larger size the skull and teeth do not differ appreciably from those of the central European forms.

Measurements.—Type (adult male): head and body, 280; tail, 230; hind foot, 65; ear, 35. Adult female from La Granja, Segovia: head and body, 256; tail, 220; hind foot, 66; ear, 33. For cranial measurements see Table, p. 922.

Specimens examined.—Five, from the following localities in central Spain: Las Navas, Avila, 1 (U.S.N.M.); La Granja, Segovia, 3 (B.M. and Cabrera); no exact locality, 1.

♂.	Old Castile, Spain.	Lord Lilford (P).	94. 6. 11. 6.
♂.	La Granja, Segovia. (*Escalera.*)	A. Cabrera (P).	7. 10. 17. 1.

Sciurus vulgaris segurae Miller.

1909. *Sciurus vulgaris segurae* Miller, Ann. and Mag. Nat. Hist., 8th ser., III, p. 418, May, 1909. Type in British Museum.
1910. *Sciurus vulgaris segurae* Trouessart, Faune Mamm. d'Europe, p. 121.

Type locality.—Molinicos, Sierra de Segura, Albacete, Spain.

Geographical distribution.—Known only from the Sierra de Segura, provinces of Albacete and Jaen, south-eastern Spain.

Diagnosis.—Related to *Sciurus vulgaris infuscatus*, but back less blackish, its underfur light grey, tail less red and with white area on under surface less well developed, and cheeks light grey, forming no decided contrast with white of throat.

Colour.—Summer pelage: upper parts a fine, inconspicuous grizzle of wood-brown and blackish, the general effect resembling the mars-brown of Ridgway, blackening on flanks, across posterior half of back, and on postero-outer side of thighs; in some specimens the light element is more nearly russet and the black is essentially absent; underfur pale ecru-drab, the hairs with faintly brownish tips; ears and crown like back, but face with a rusty wash, and muzzle and cheeks to behind base of ear light clear ecru-drab, so pale as to form no marked contrast with white of throat; underfur of head, back, sides, and limbs pale ecru-drab like that of cheeks, appearing conspicuously at surface in specimens with abraded pelage; feet a dull ferruginous, this colour extending up outer side of thigh and over entire fore leg, in both regions diluted by the ecru-drab of underfur; entire underparts and inner surface of legs buffy white to base of hairs; tail blackish, slightly tinged with dull red, the hairs becoming ecru-drab at base; whole tail sprinkled with pure white hairs more numerous along median line below than elsewhere, and usually (in eight of the eleven skins examined) forming a distinct white median area as in *S. v. infuscatus*.

Skull and teeth.—The skull and teeth do not differ appreciably from those of *Sciurus vulgaris infuscatus*.

Measurements.—Type (adult female): head and body, 245; tail (probably injured in life), 195; hind foot, 61. Average and extremes of seven specimens from the Sierra de Segura: head and body, 235·7 (230–245); tail, 210 (200–220); hind foot, 61·8 (60–64·4); ear, 25·8 (25–30). For cranial measurements see Table, p. 922.

Specimens examined.—Eleven, all from the Sierra de Segura.

CRANIAL MEASUREMENTS OF *SCIURUS VULGARIS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Mastoid breadth.	Postorbital constriction.	Interorbital constriction.	Rostral breadth at front of nasals.	Nasal.	Diastema.	Mandible.	Maxillary toothrow.	Mandibular toothrow.	Observations.
S. vulgaris vulgaris.														
Norway: Spjotsod, Telemarken	121353	♂	49·2	32·4	22·6	17·2	17·0	8·0	16·0	12·8	34·2	10·0	9·2	Teeth moderately worn.
,, ,,	121351	♀	47·0	31·2	22·2	17·8	16·4	7·6	14·8	12·0	32·4	9·4	9·0	,, slightly worn.
Sundal . . .	99. 9. 5. 1		46·0	30·4	21·6	18·0	16·6	7·4	16·0	11.8	32·8	9·2	9·4	,, not worn.
,, . . .	99. 9. 5. 2		47±	-	22·0	17·4	17·8	—	16·2	12·6	33·6	9·0	9·0	,, ,,
Foldalen . .	97. 3. 13. 13	♂	46·4	30·2	21·6	17·0	16·8	8·0	—	12·2	32·8	9·0	9·0	,, much worn.
Aker, Christiania .	97. 3. 13. 3		46·0	31·8	21·0	16·8	16·1	8·2	16·0	12·8	33·2	9·0	—	,, not worn.
,, ,, .	97. 3. 13. 4		47·2	—	21·4	17·4	16·6	8·2		12·6	33·2	9·6	9·6	,, slightly worn.
,, ,, .	97. 3. 13. 5		46·4	30·0	21·8	18·2	16·8	7·6	14·6	12·6	32·2	9·0	9·2	,, not worn.
,, ,, .	105106	♂	47·6	31·4	21·8	16·8	16·6	8·0	15·0	12·2	32·8	9·2	10·2	,, slightly worn.
,, ,, .	105107	♀	46·0	30·4	22·0	16·6	16·2	7·6	15·2	12·0	32·0	9·2	9·0	,, moderately worn.
near Christiania .	97. 4. 11. 1	♂	46·8	32·0	22·0	17·8	18·0	8·2	15·4	11·6	33·0	9·2	9·4	,, slightly worn.
,, ,, .	97. 4. 11. 2	♂	45·0	32·0	21·0	18·0	17·4	8·2	15·0	12·0	—	9·2	—	,, ,,
,, ,, .	97. 4. 11. 4	♀	47·4	31·2	21·8	17·6	17·0	8·0	15·4	12·4	33·0	9·0	9·0	,, ,,
Sweden: Upsala . . .	85072	♂	47·2	31·0	23·0	18·0	16·6	7·8	15·0	12·0	32·0	10·0	9·0	
,, . . .	85075	♂	46·4	32±	24·4	17·4	17·8	8·0	15·8	11·6	32·8	9·8	9·2	,, ,,
,, . . .	85076	♀	48·0	33·0	25·4	18·0	17·6	8·2	16·0	13·0	33·0	9·6	9·6	
S. vulgaris varius.														
Finland: Kirkkonummi .	98. 11. 4. 2	♂	46·0	30·2	21·2	17·0	16·2	7·8	15·0	11·6	31·8	9·2	9·2	,, not worn.

S. vulgaris russus.														
Holland : Guelderland . .	98. 2. 1. 13	♂	47·0	30·4	22·0	17·2	16·0	7·8	15·2	12·2	31·2	9·0	9·4	Teeth slightly worn.
Graveland . .	98. 11. 13. 1*a*	♀	48·0	31·0	22·8	17·6	17·8	8·6	16·0	13·0	32·4	9·4	9·8	,, much worn.
,, . .	98. 11. 13. 1*b*	♀	48·0	30·0	22·0	17·6	17·0	8·2	15·6	12·4	33·4	10·0	9·6	,, not worn.
,, . .	98. 11. 13. 2	♀	48·0	31·0	22·4	18·0	16·0	8·8	15·8	13·0	32·6	9·4	9·6	,, slightly worn.
France : Dinan, Côtes-du-Nord	97. 11. 6. 1	♂	45·4	29·4	21·2	18·0	16·6	7·4	14·8	11·8	31·0	9·0	9·6	,, ,,
,, ,,	97. 11. 6. 2*	♂	46·0	29·0	21·2	16·8	15·4	7·4±	15·2	12·4	31·4	9·0	8·6	,, moderately worn.
,, ,,	97. 11. 6. 3	♂	46·0	30·0	21·0	16±	16·0	7·0	15·0	11·8	30·0	9·4	9·6	,, slightly worn.
,, ,,	97. 11. 6. 4	♂	45·4	30·4	21·2	17·6	16·0	8·0	14·6	12·0	31·0	9·6	9·4	,, ,,
S. vulgaris leucourus.														
England : Blandford, Dorset .	87. 1. 6. 2	♂	45·8	30·0	22·0	17·0	17·0	7·8	15·4	12·0	32·0	9·0	8·8	,, moderately worn.
,, ,, .	97. 1. 6. 16	♂	46·0	30·8	21·4	17·4	17·0	8·0	14·8	12·2	32·0	9·2	9·0	,, ,,
,, ,, .	97. 1. 6. 22	♂	45·8	30·0	21·6	17·6	16·8	8·2	15·0	12·4	32·2	9·2	9·2	,, not worn.
,, ,, .	97. 1. 6. 25	♂	44·6	29·8	21·2	—	17·0	8·0	14·4	11·8	32·6	9·0	9·0	,, moderately worn.
,, ,, .	97. 1. 6. 38	♂	44·6	30·0	21·2	17·2	16·6	7·8	14·2	11·4	31·2	9·0	9·0	,, ,,
,, ,, .	97. 1. 6. 52	♂	48·0	31·2	21·8	18·2	18·0	8·4	15·4	12·8	32·8	9·4	9·2	,, ,,
,, ,, .	97. 1. 6. 5	♀	44·0	29·0	21·8	17·6	17·0	7·0	13·8	11·0	30·0	9·0	9·4	,, not worn.
,, ,, .	97. 1. 6. 6	♀	47·0	31·4	21·8	17·8	17·2	8·0	14·8	12·4	32·6	9·0	8·4	,, much worn.
,, ,, .	97. 1. 6. 8	♀	46·2	—	21·8	18·2	—	—	—	13·0	32·8	9·0	9·2	,, moderately worn.
,, ,, .	97. 1. 6. 9	♀	46·2	31·2	—	17·0	16·8	7·8	15·4	12·6	32·2	9·0	9·0	,, ,,
,, ,, .	97. 1. 6. 13	♀	46·4	31·0	21·4	17·2	17·6	8·0	15·2	12·8	32·8	9·0	9·0	,, ,,
,, ,, .	97. 1. 6. 19	♀	46·0	30·4	22·0	17·4	16·8	7·6	15·0	12·6	31·0	9·0	9·0	,, much worn.
,, ,, .	97. 1. 6. 26	♀	46·8	30·2	21·4	17·4	17·4	7·8	15·4	12·2	32·0	9·2	9·0	,, slightly worn.
,, ,, .	97. 1. 6. 32	♀	45·2	30·2	22·0	17·4	17·2	7·8	15·2	11·8	32·2	9·2	9·2	,, ,,
,, ,, .	97. 1. 6. 36	♀	47·8	31·6	22·2	17·6	17·8	8·0	15·8	12·8	—	9·2	—	,, moderately worn.
,, ,, .	97. 1. 6. 51	♀	46·8	30·2	21·2	17·4	17·2	8·0	15·0	12·6	32·2	9·4	9·0	,, slightly worn.
,, ,, .	97. 1. 6. 53	♀	47·2	31·4	22·0	17·2	17·8	8·8	15·8	12·6	33·6	9·6	9·4	,, moderately worn.
,, ,, .	97. 1. 6. 54	♀	44·8	29·8	21·0	17·2	16·0	7·8	14·8	12·0	31·6	8·8	8·8	,, ,,
Barrow, Suffolk .	113264	♂	45·6	29·8	21·2	17·8	16·8	7·6	14·2	11·6	30·0	8·8	8·6	,, much worn.
,, ,, .	113265	♂	46·0	30·2	21·6	17·8	16·4	7·4	14·0	12·4	31·0	9·2	8·8	,, ,,
,, ,, .	113266	♀	46·2	29·8	—	17·8	17·0	7·2	14·8	12·2	31·6	9·2	9·0	,, moderately worn.

* Type.

CRANIAL MEASUREMENTS OF *SCIURUS VULGARIS*—*continued*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Mastoid breadth.	Postorbital constriction.	Interorbital constriction.	Rostral breadth at front of nasals.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
S. vulgaris fuscoater.														
Germany: Ingelheim, Rheinhessen	8. 11. 2. 33	♀	50·0	33·0	23·6	18·2	17·8	8·4	17·.	13·2	34·8	10·2	10·0	Teeth slightly worn.
,, ,,	8. 11. 2. 34	♀	48·8	34·2	23·2	17·8	17·6	8·0	16·0	13·0	33·6	10·0	10·0	,, ,,
,, ,,	8. 11. 2. 35	♀	48·8	32·8	23·0	18·8	18·2	8·0	16·0	13·2	33·0	10·0	9·8	,, ,,
Ummerstadt, Thüringen	11. 1. 1. 72		47·0	31·0	24·0	18·0	16·6	8·0	15·0	12·2	31·4	9·6	9·4	,, ,,
Schwarzburg, Thüringen	95. 4. 18. 9	♂	49·4	31·4	22·2	17·0	16·8	7·6	15·6	13·0	33·4	9·8	9·6	,, ,,
,, ,,	95. 4. 18. 10	♀	47·0	30·0	22·8	16·8	17·0	8·6	14·6	13·0	32·4	9·0	9·0	,, ,,
,, ,,	95. 4. 18. 11	♀	48·0	31·0	22·2	18·0	17·2	7·8	15·4	12·8	33·0	9·8	9·0	,, ,,
Rudolstadt, Thüringen	95. 4. 18. 7*	♂	46·6	30±	22·6	18·0	17·0	8·6	15·4	12·2	33·0	9·6	9·6	,, not worn.
,, ,,	95. 4. 18. 8	♀	47·6	32·2		17·6	—	8·0	16·2	12·4	33·6	10·0	9·6	,, slightly worn.
Niesky, Silesia	97. 12. 4. 20	♀	49·0	32·0	23·0	17·2	17·2	8·0	16·2	12·4	—	10·2	—	,, much worn.
Roumania: Bustenari	4. 4. 6. 67	♂	48·8	32·0	22·8	17·6	17·8	8·0	16·6	13·0	34·0	9·0	9·0	,, ,,
,,	4. 4. 6. 68	♂	49·0	31·4	22·6	18·0	17·2	8·8	16·0	13·0	33·4	9·8	9·0	,, slightly worn.
,,	4. 4. 6. 70	♀	48·0	31·0	22·2	17·6	16·8	8·0	16·0	12·6	32·0	9·0	9·6	,, moderately worn.
Switzerland: Brunig, Bern	5638 Field	♂	48·2	32±	23·0	18·2	19·0	8·4	16·0	13·2	34·0	9·6	9·4	,, slightly worn.
St. Gallen	115217	♂	48·0	32·2	22·8	18·0	18·2	8·0	15·2	12·6	33·4	9·8	9·4	,, moderately worn.
,,	4. 4. 5. 36	♂	47·0	30·4	22·0	18·0	18·0	7·8	15·0	12·2	32·0	9·2	9·2	,, ,,

Switzerland: St. Gallen .	4. 4. 5. 38	♀	47·2	30·6	22·2	17·6	16·8	7·8	15·8	12·4	33·6	9·2	9·4	Teeth not worn.	
Untervatz, St. Gallen .	123647	♂	47·6	31·4	22·4	17·2	16·4	8·2	15·4	12·6	33·2	9·8	9·4	,,	,,
,, ,,	4. 4. 5. 39	♀	48·8	32·2	23·2	18·2	16·6	8·2	15·2	12·8	34·0	9·8	9·2	,,	much worn.
,, ,,	4. 4. 5. 40	♀	47·8	—	22·4	17·8	17·0	8·4	15·0	13·2	—	9·4	9·4	,,	slightly worn.
Herisau . .	115169	♂	47·8	31·2	22·2	17·4	—	8·4	15·8	12·8	32·8	9·8	9·2	,,	moderately worn.
S. vulgaris italicus.															
Italy: Western Liguria, Cascinele .	Genoa 1	♂	47·6	32·2	22·6	18·8	17·6	8·2	16·0	12·8	—	9·8	9·2	,,	slightly worn.
Cornice .	,, 3	♂	45·2	32·0	21·6	18·4	16·6	7·8	15·2	12·6	32·0	9 2	9·0	,,	not worn.
Vaccarezza .	,, 21	♂	47·8	31·4	22·4	18·0	17·2	8·4	15·0	12·8	33·2	9·8	9·4	,,	slightly worn.
Finalborgo .	,, 34	♂	47·4	31·2	21·8	18·0	17·2	8·8	15·0	12·6	32·2	9·8	9·0	,,	,,
,, .	,, 86	♂	47·0	30·0	21·4	17·2	16·6	8·0	14·8	12·4	31·8	9·2	9·0	,,	not worn.
Prà-Fagaggia	,, 2	♀	47·2	32·4	—	18·6	17·4	8·6	15·0	13·0	32·6	9·4	9·2	,,	slightly worn.
Siena	98. 10. 2. 9	♂	—	30·0	22·6	18·0	16·6	7·4	14·2	12·0	—	10·0	—	,,	,,
,, . . .	98. 10. 2. 10	♂	46·0	31·2	22·0	18·8	17·0	7·4	15·2	12·2	31·0	9·8	10·0	,,	,,
,, . . .	6. 7. 5. 1		48·0	31·0	22·2	18·0	17·0	7·6	15·8	13·4	33·6	9·6	9·6	,,	not worn.
,, . . .	6. 7. 5. 2		48·0	31·6	22·4	18·4	17·6	8·2	15·0	12·8	33·6	10·0	9·8	,,	,,
,, . . .	152734		47·0	31·0	24·6	18·0	16·8	7·8	15·4	12·8	32·0	9·8	9·4		
S. vulgaris lilæus.															
Greece: Parnassus . .	7. 9. 8. 1†	♀	—	31·4	—	17·8	17·0	7·4	14·0	12·8	32·4	9·8	9·8	,,	slightly worn.
,, . .	152737	♀	—	30·0	24±	17·4	16·0	6·8	14·0	12·2	31·4	9·4	9·6	,,	worn.
,, . .	8. 10. 17. 1	♀	48±	31·2	23·8	18·2	17·2	7·8	15·2	13·0	33·8	10·0	10·2	,,	not worn.
S. vulgaris alpinus.															
Spain: Lérida . . .	152265		—	31·0	—	17·8	16·4	8·0	14·0	11·4	30·4	9·0	8·8		

* Type of *rutilans* Miller.

† Type.

CRANIAL MEASUREMENTS OF *SCIURUS VULGARIS*—*continued*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Mastoid breadth.	Postorbital constriction.	Interorbital constriction.	Rostral breadth at front of nasals.	Nasal.	Diastema.	Mandible.	Maxillary toothrow.	Mandibular toothrow.	Observations.
S. vulgaris numantius.														
Spain: Panticosa, Huesca .	8. 2. 9. 62	♂	51·0	33·4	21·0	17·0	18·0	8·8	17·4	13·4	35·0	10·4	10·2	Teeth slightly worn.
,, ,, .	152739	♂	50·0	32·2		18·0	18·4	8·6	16·0	12·8	34·0	10·0	9·4	
,, ,, .	152738	♀	50·0	33·0	—	17·6	19·0	8·2	16·4	13·6	34·0	9·4	9·6	
,, ,, .	8. 2. 9. 64	♀	49·4	32·6	22·8	18·0	18·0	8·4	16·2	13·2	33·4	9·2	9·6	,, slightly worn.
,, ,, .	8. 2. 9. 63	♂	49·8	32·2	22·8	17·8	18·2	9·0	16·4	13·2	—	10·0	—	,, not worn.
Arrechavaleta, Vitoria	8. 2. 9. 65	♂	50·4	33·0	22·8	17·8	19·0	8·6	16·4	13·0	33·4	9·6	9·4	,, slightly worn.
,, ,,	8. 2. 9. 66	♂	48·0	—	22·2	17·6	18·6	8·0	15·2	13·0	33·4	9·8	10·0	,, ,,
Quintanar, Burgos .	8. 8. 4. 54	♀	49·4	33·0	26·0	18·0	18·0	8·0	16·4	13·2	34·0	9·8	10·0	,, ,,
,, ,, .	8. 8. 4. 55	♀	48·4	32·2	25·0	17·2	18·4	8·0	15·8	13·0	34·0	9·8	10·0	,, worn.
,, ,, .	8. 8. 4. 52*	♀	50·0	33·0	23·0	17·4	18·8	8·2	16·0	13·0	34·0	9·8	10·0	,, moderately worn.
S. vulgaris infuscatus.														
Spain: Las Navas, Avila .	152266*	♂	52·4	35·4	26·0	17·4	18·0	8·8	18·6	15·4	36·2	10·0	10·2	,, worn.
La Granja, Segovia .	7. 10. 17. 1	♂	53·0	35·0	24·8	18·0	20·0	9·8	18·4	14·0	37·0	10·8	10·2	,, slightly worn.
,, ,, .	120 Cabrera	♀	55·0	36·4	26·4	19·0	20·0	9·8	19·0	13·8	37·6	11·0	11·0	
S. vulgaris seguræ.														
Spain: Sierra de Segura .	8. 9. 24. 1	♂	50·8	32·6		17·6	18·4	8·8	17·0	12·8	35·2	10·2	10·0	,, not worn.
,, .	8. 9. 24. 2	♂	51·2	32·6	24·0	17·6	18·6	8·6	—	12·8	34·8	10·2	10·0	,, ,,
,, .	8. 9. 24. 3*	♂	51·8	33·4	24·0	17·8	19·6	8·6	17·8	13·0	35·6	10·4	10·0	,, ,,
,, .	8. 9. 24. 4	♀	51±	—	—	17·2	18·6	8·8	17·4	13·0	35·6	10·4	10·0	,, ,,
,, .	8. 9. 24. 5	♀	52±	—	—	18·0	19·0	8·8	17·2	12·8	35·2	10·2	9·8	,, slightly worn.
,, .	152743	♀	50·8	33·2	—	18·4	18·8	9·0	16·8	13·0	35·2	10·2	10·0	,, not worn.
,, .	152744	♀	—	33·0	23·6	18·0	18·8	—	16·8	—	35·2	10·4	10·0	,, ,,
,, .	152747	♀	51±	32·2	—	17·4	18·4	9·0	17·2	12·6	35·8	10·4	10·2	,, ,,

* Type.

Remarks.—While this animal is readily distinguishable from the squirrels of central and northern Spain its distinctness from the imperfectly known *Sciurus vulgaris bæticus* is perhaps open to doubt. In an obviously immature individual, however, the hind foot is 60 mm. in length as opposed to 45 mm. in the type of *bæticus*.

2 ♂, 1 ♀ Sierra de Segura, Albacete, Spain.	M. de la Escalera (c)	8. 9. 24. 1-6. (8. 9. 23. 3 *Type* of subspecies.)

SCIURUS VULGARIS BÆTICUS Cabrera.

1905. *Sciurus bæticus* Cabrera, Bol. Real Soc. Españ. Hist. Nat., v, p. 228, April, 1905. Type in museum of University of Seville.

1910. *Sciurus vulgaris bæticus* Cabrera, Asoc. Españ. Progr. Cien., Congr. Zaragosa, 1908, p. 11, June, 1910.

1910. *Sciurus vulgaris bæticus* Trouessart, Faune Mamm. d'Europe, p. 122.

Type locality.—Alanis, Province of Seville, Spain.

Geographical distribution.—At present known from the type locality only.

Diagnosis.—In general much like *Sciurus vulgaris seguræ*, but size considerably less (hind foot only about 50 mm.) and white area on underparts unusually narrow.

Remarks.—This squirrel, of which I have seen no specimens, appears to be similar to *Sciurus vulgaris seguræ* except for its small size, the absence of white in the tail, and the narrowness of the white ventral area. The type is an immature mounted specimen in summer coat; and its skull has not been examined. The more important parts of the original description are essentially as follows: Probably the smallest of the European forms of the genus *Sciurus;* further distinguished * by having the tail unicolor and similar to the body. Pelage a bright reddish chestnut above, white below. The white is not so extensive as in *S. vulgaris infuscatus*, being limited to the median portion of the ventral surface. Sides of the face in region of eyes much paler than the rest of the head, approaching a dirty yellowish. Tail of the same colour as the body, uniform, without white hairs on its lower surface. Dimensions (approximate): head and body, 200; tail, 160; hind foot without claws, 50. In a later paper Mr. Cabrera corrects the measurements of tail and hind foot to 135 and 45 mm. respectively, adding that, from information which he has received he believes the size of the adult animal to be about as in *numantius*. If this is true it seems not improbable that *seguræ* will prove to be the same as *bæticus*.

* (from *infuscatus*).

Genus **CITELLUS** Oken.

1816. *Citellus* Oken, Lehrb. der Naturgesch., Th. III, Abth., II, p. 824 (*citellus*).
1825. *Spermophilus* F. Cuvier, Dents des Mammifères, p. 160 (*citellus*).
1827–34. *Citillus* Lichtenstein, Darstell. neuer oder wenig bekannter Säugeth., pl. XXXI (*citillus*).
1857. *Spermophilus* Blasius, Säugethiere Deutschlands, p. 275.
1902. *Citellus* Allen, Bull. Amer. Mus. Nat. Hist., XVI, p. 375, October 11, 1902.

Type species. *Mus citellus* Linnæus.

Geographical distribution. Northern Hemisphere from Hungary eastward through Asia and North America to the central United States.

Characters. Strictly terrestrial *Sciuridæ* of medium size and slightly modified Sciurine aspect, the tail flattened but relatively shorter and less bushy than in *Sciurus*; cheek pouches present; skull more massive than in *Sciurus*, the brain-case much less convex above, its depth rather more than twice that of rostrum; incisors sub-terete; molars with cross-ridges and inner tubercle relatively high, obscuring the basin-shaped form of crown, and forming a conspicuous U shaped pattern in moderately worn teeth; anterior upper premolar well developed.

Remarks.—Though the limits of the genus *Citellus* are not at present well understood, owing chiefly to the difficulty of comparing the Old World and American forms, the group may be regarded as containing about eight Palæarctic species, two of which occur in central Europe. Remains of extinct members of the genus are found as far west as England.

KEY TO THE EUROPEAN SPECIES OF *CITELLUS*.

Back without distinct spots; skull with incisive foramina normal, their length greater than diameter of alveolus of upper incisor (Hungary in general, and eastward) ..... *C. citellus*, p. 924.

Back with sharply defined whitish spots about 4 mm. in diameter; skull with incisive foramina very small, their length about equal to diameter of alveolus of upper incisor (Hungary east of the Carpathians, and eastward) ..... *C. suslica*, p. 929.

CITELLUS CITELLUS Linnæus.

1766. [*Mus*] *citellus* Linnæus, Syst. Nat. I, 12th ed., p. 80 (Austria).
1778. *Mus citillus* Pallas, Nov. Sp. Quadr. Glir. Ord., p. 19.
1857. *Spermophilus citellus* Blasius, Säugethiere Deutschlands, p. 275.
1904. [*Citellus*] *citellus* Trouessart, Catal. Mam. Viv. Foss., Suppl., p. 339.
1910. *Citellus* (*Citellus*) *citellus* Trouessart, Faune Mamm. d'Europe, p. 127.

Type locality. Austria.

Geographical distribution. From Silesia and Bohemia, east-

ward through Russia into Asia; eastern limits of range not known.

Diagnosis.—Size medium (head and body, 195 to 220 mm.; tail, 60 to 75; hind foot, 35·4 to 38·4; condylobasal length of skull, 41·4 to 45); tail short, about twice as long as hind foot; colour of upper parts mingled buff and dark brown so arranged as to produce an evident effect of light mottling on a dark ground; skull with rather low, broad brain-case; incisive foramina not unusually reduced in size; incisor teeth both above and below exhibiting the minimum degree of compression.

External characters.—General form less slender than in *Sciurus vulgaris*, the short, narrow tail extending little beyond outstretched hind feet, the ear short and without tuft, the fur thin, coarse and lying close to body. Ear low, obscurely pointed above, extending much less than half-way to eye when laid forward, densely clothed with fine short hairs on both surfaces; muzzle pad naked, the bare area extending downward as a narrow line across middle of upper lip. Feet shorter and more robust than in *Sciurus vulgaris*, the digits less elongated, the claws less curved, those on front feet longest; fore foot with third digit longest, second and fourth sub-equal and slightly shorter, fifth extending a little beyond base of fourth, the thumb rudimentary but with rather evident, compressed nail; hind foot with third digit longest, second and fourth sub-equal and slightly shorter, fifth extending just beyond base of fourth, first not quite to base of second; pads both palmar and plantar as in *Sciurus vulgaris* but relatively larger and more crowded; palm bare throughout, sole hairy behind tubercles. Tail cylindrical at base, inconspicuously flattened beyond middle, where hairs are about 15 mm. long. Mammæ; $p\ 1-1$; $a\ 2-2$; $i\ 2-2=10$.

Colour.—Back and sides usually cream-buff but occasionally more yellowish, in some specimens approaching the buff yellow of Ridgway; sides inconspicuously "lined" with black; entire dorsal surface from nape to rump vermiculated with black, the dark and light areas along middle of back usually well enough defined to produce an effect of obscure light mottling, the spots about 5 mm. in diameter; crown and upper half of cheeks grizzled, the light element paler than on body, the dark relatively more evident; an ill-defined eye-ring, whitish or yellowish according to general colouring of body; muzzle sometimes with a rusty tinge; sides of muzzle and lower half of cheeks clear whitish or buffy, continuous with the similarly coloured pale area covering throat and fore part of chest and inner side of fore leg; belly washed with a buff usually somewhat more yellow than that of sides; feet like ground colour of back; tail without definite colour pattern, the upper surface grizzled, essentially like back, somewhat darker at tip, the pencil with light margin; under surface of tail a nearly clear dull buff.

Skull. The skull is smaller than that of *Sciurus vulgaris*,

and its general form differs notably in the cuneate outline due to the narrowness of anterior zygomatic region, the almost uniformly convex dorsal profile, and the slight deflection of basicranial axis, so that upper third or fourth of foramen magnum is above level of alveolar line. Dorsal profile convex from front of nasals to lambdoid ridge, sometimes with a slight flattening in interorbital region and a faint posterior concavity; ventral profile similar, though less strongly convex; posterior truncation of brain-case nearly vertical, but occipital condyles projecting

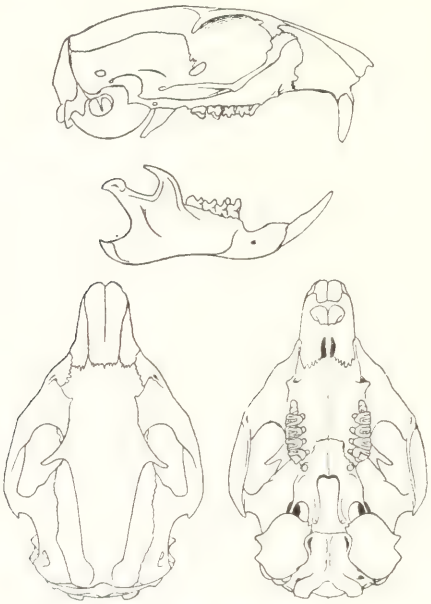


FIG. 188.
Citellus citellus. Nat. size.

sufficiently to be just visible from above. Brain-case very broadly ovate when viewed from above, its greatest width equal to length, its posterior width obviously exceeding than that at postorbital constriction; surface less rounded than in *Sciurus vulgaris*, and lyrate figure formed by parietal ridges much narrower; lambdoid crest essentially as in *S. vulgaris*, but constriction just in front of occipital region less evident. Occiput low, its general form as in *Sciurus vulgaris*, but contrast between its height and that of middle of brain-case not especially marked; protuberances on posterior surface of occiput less noticeable than

in *S. vulgaris*, and exposed portion of petrosal noticeably smaller; paroccipital processes rather large, their extremities reaching beyond level of lower edge of condyle and often to that of lower edge of bulla; basioccipital essentially like that of *Sciurus vulgaris* in general form, but anterior portion of outer margin raised into a conspicuous plate-like process applied to inner side of bulla; auditory bulla essentially as in *Sciurus vulgaris* but more evenly though somewhat less inflated. Interorbital region much longer than broad, its least width less than that of postorbital constriction, its surface nearly flat except for the curve of which it forms a part; edges of orbits slightly raised above the general level, the supraorbital notch inconspicuous; postorbital processes relatively shorter than in *Sciurus vulgaris*, the space lying between process and surface of brain-case narrower; orbit surrounded by bone through about two-thirds of its circumference. Zygomata diverging gradually and evenly, nowhere parallel, the greatest zygomatic breadth at or just in front of glenoid level; jugal projecting posteriorly as in *Sciurus vulgaris* though less noticeably, its upper border without angle at posterior limit of orbit; anterior zygomatic root with conspicuous projecting ridge extending along its entire anterior border; anteorbital foramen sub-circular in outline, its position somewhat more anterior in relation to tooth-row than in *Sciurus vulgaris*, its entire lower and outer border thickened and lip-like. Rostrum forming about one-third length of skull, its base not noticeably broader than anterior region, the least depth behind incisors about equal to width at same level; nasals relatively longer than in *Sciurus vulgaris*, extending about to lachrymal level, the posterior border variable, usually truncate; nasal branches of premaxillaries broad but not expanded, rarely extending behind nasals. Palate less concave both longitudinally and laterally than in *Sciurus vulgaris;* a low but evident median ridge extending from incisive foramina to spine or blunt projection at posterior border; incisive foramina about as large as in *S. vulgaris*, but more distinct from each other, and anterior extremity not gradually narrowed to a fine point; mesopterygoid fossa about three times as long as wide, narrowest near middle; ectopterygoid rather well developed, forming a wide flattened area nearly as large as mesopterygoid space. Mandible less robust than that of *Sciurus vulgaris*, the ramus in region near symphysis scarcely deeper than wide; coronoid process longer and more curved than in *S. vulgaris*, its anterior border much more convex; articular process slender, deeply concave on outer side; angular process with anterior limit less well defined.

Teeth.—Upper incisor less robust than that of *Sciurus vulgaris*, but course of shaft very distinctly marked on side of rostrum from alveolus to anteorbital foramen; cross section of shaft nearly semicircular in outline, the flattened side turned inward; enamel extending from antero-internal extremity nearly

half-way along anterior and outer curvature, its surface smooth, yellowish white. Lower incisor with root extending slightly beyond m_3; section of shaft and arrangement of enamel essentially as in upper tooth, but outer border flattened behind enamel plate, thus distorting the semicircular outline. Cheek-teeth agreeing with those of *Sciurus vulgaris* in general plan of enamel folding but differing in numerous details, principally the result of a tendency toward greater height of tubercles and main ridges. Anterior upper premolar simple, terete, its crown with high, median, obliquely transverse ridge and small anterior and posterior depression, the area of crown about one-half that of succeeding tooth. Upper cheek-teeth with inner tubercle much narrower and higher than in *S. vulgaris*, the length of base scarcely equal to height, the width of base decidedly greater than length; main ridges (second and fourth) simple but high, extending to summit of inner tubercle and forming, together with the tubercle, a narrowly U-shaped figure, the most conspicuous feature of crown when not worn away; anterior ridge very narrow, at extreme edge of crown, separated from base of second ridge by a conspicuous furrow, its outer extremity forming a slight cusp, its abruptly rounded inner termination lying on anterior surface of base of main tubercle; third ridge represented by a minute cusp between outer extremities of U-shaped figure, the space between the limbs of the U occupied by a smooth depression; posterior margin of crown with a ridge terminating internally like anterior ridge, but not extending to outer margin. The principal variations of this pattern are: in pm^4, second limb of U, with its outer cusp somewhat reduced; in m^2, second limb of U obsolete and distorted, not extending to outer border of tooth, the posterior half of crown occupied by a shallow, basin-shaped area usually bearing a low but evident cusp on its inner border. Lower molariform teeth with the same elements as in *Sciurus vulgaris*, but crowns higher and more compressed, the central depression deeper and narrower, the cusps high and conspicuous, particularly the antero-external and antero-internal, which are connected by a well-developed ridge having much the appearance of a common base to the two cusps; inner side of bases of two outer cusps joined by a low ridge, beyond which lies a small but rather deep depression.

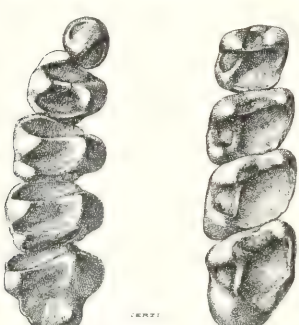


FIG. 189.

Citellus citellus. Cheek-teeth. × 5.

Measurements.—Average and extremes of four adults from

Hirschberg, Bohemia: head and body, 200 (195–215); tail, 66 (60–73); hind foot, 36·6 (35·4–38·4). Average and extremes of six adults from Znaim, Mähren, Austria-Hungary: head and body, 209·1 (200–220); tail, 63·7 (58–70); hind foot, 36·4 (35·6–37). For cranial measurements see Table, p. 930.

Specimens examined.—Thirty-nine, from the following localities:—
Austria-Hungary: Haida, Arva, Bohemia, 1; Hirschberg, Bohemia, 5; Znaim, Mähren, 7; Csallóköz-Somorja, western Hungary, 4; central Hungary, 1; Sárvár, Eisenburg, Hungary, 1 (U.S.N.M.); Monos Petrie, Bihar, 2; Csehtelek, Bihar, 6.
Roumania: Kustendje, 2; Dobrudscha, 3 (B.M., U.S.N.M. and Genoa); Moldavia, 3.
Bulgaria: Bogoroff, Sofia, 1; Sofia, 2 (Andersen).
Turkey: Ob-Meidan, 1.

2 ♂, 2 ♀.	Hirschberg, Bohemia, Austria-Hungary.	Lord Lilford (P).	8. 9. 10. 1–4.
♂, 3 ♀.	Znaim, Mähren.	Lord Lilford (P).	8. 9. 10. 1–4.
4.	Csallóköz-Somorja, Pressburg, 400 ft.	Budapest Museum (E).	94. 3. 1. 33–36.
2 ♀.	Monos Petrie, Bihar.	Hon. N. C. Rothschild (C & P).	9. 7. 23. 1–2.
2 ♂, 4 ♀.	Csehtelek, Bihar.	Hon. Mrs. Chas. Rothschild (C & P).	10. 9. 14. 2–7.
2.	Kustendje, Roumania.	E. Cavendish Taylor (C & P).	5. 5. 6. 16–17.
1.	Dobrudscha.	Purchased (Prulière).	86. 4. 2. 3.
1.	Moldavia.	Dr. E. Rüppell.	42. 9. 4. 1.
1.	Moldavia.	Purchased (Leadbeater).	43. 9. 11. 2.
1.	Moldavia.	Dr. J. E. Gray (P).	123. a.
♀.	Bogoroff, Sofia, Bulgaria.	Dr. A. Richards (C & P).	2. 10. 5. 1.

CITELLUS SUSLICA Gueldenstaedt.

1770. *Mus suslica* Gueldenstaedt, Nov. Comm. Acad. Sci. Imp. Petrop., XIV, pt. I, p. 389 (Voronezh, Russia).

1770. [*Mus citellus*] var. *guttatus* Pallas, Nov. Comm. Acad. Sci. Imp. Petrop., XIV, pt. I, p. 506, pl. 21, fig. 2 (Doubtfully a name).

1792. [*Arctomys*] *citellus* β *leucopictus* Donndorff, Zool. Beyträge, I, p. 486 (Renaming of *guttatus*).

1845. *Sp*[*ermophilus*] *guttulatus* Schinz. Synop. Mamm., II, p. 70 (Renaming of *guttatus*).

1910. *Citellus guttatus* Trouessart, Faune Mamm. d'Europe, p. 128.

Type locality.—Voronezh, Chernigof, Russia.

Geographical distribution.—Central Russia and eastern Hungary.

Diagnosis.—Slightly smaller than *Citellus citellus*, and tail relatively shorter; back marked with sharply defined whitish spots about 4 mm. in diameter; skull smaller than that of *C. citellus*, the rostrum and palate narrower and incisive foramina much reduced in size.

Colour.—Dorsal area from nape to base of tail a tawny russet faintly clouded by blackish hair tips, and thickly spotted with

CRANIAL MEASUREMENTS OF *CITELLUS CITELLUS* AND *C. SUSLICA*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Breadth of rostrum at front of nasals.	Interorbital breadth.	Postorbital breadth.	Mastoid breadth.	Occipital depth.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
C. citellus.															
Austria-Hungary: Hirschberg, Bohemia	8. 9. 10. 1	♂	44·0	29·6	8·0	9·8	11·2	21·2	13·2	16±	11·4	31·0	10·4	10·0	Teeth slightly worn.
,, ,,	8. 9. 10. 2	♂	41·6	28·8	7·2	9·2	11·6	20·2	12·2	15·6	11·6	29·2	10·2	10·0	,, ,,
,, ,,	8. 9. 10. 3	♀	42·6	28·8	7·2	9·4	11·4	20·0	12·6	—	11·4	29·8	9·4	9·6	,, moderately worn.
,, ,,	152752	♀	42·4	28·8	7·4	9·4	11·4	19·4	13·0	16·2	12·0	29·0	9·4	9·4	,, ,,
,, ,,	8. 9. 10. 4	♀	41·4	28·0	7·4	9·2	11·4	19·2	12·2	15·2	11·6	29·8	9·4	9·2	,, ,,
,, Zuaim, Mahren	8. 9. 10. 5	♂	44·8	28·8	7·8	9·8	11·4	20·8	13·2	17·2	12·0	30·2	10·0	9·2	,, slightly worn.
,, ,,	152755	♂	44·2	29·4	7·6	10·0	12·8	20·6	13·4	15·2	12·0	30·4	9·4	9·2	,, ,,
,, ,,	8. 9. 10. 6	♂	42·0	28·0	8·0	10·0	12·6	20·0	13·8	16·4	12·2	29·4	9·4	9·0	,, ,,
,, ,,	8. 9. 10. 7	♀	43·6	28·2	7·8	9·8	12·2	20·2	13·0	16·8	11·6	30·0	9·8	9·6	,, ,,
,, ,,	8. 9. 10. 8	♀	44·0	29·6	7·6	9·6	11·6	20·8	13·0	15·4	12·4	29·8	9·6	9·6	,, moderately worn.
,, ,,	152754	♀	43·6	29·2	7·8	9·4	12·0	20·2	13·0	16·6	11·8	30·8	10·0	9·6	,, much worn.
C. suslica.															
Hungary: Galicia . .	86. 4. 2. 2	♀	—	—	7·2	8·4	10·8	—	—	14·8	10·4	27·8	9·2	8·2	,, moderately worn.

buffy white, the spots roundish, varying from 2 to 5 mm. in diameter, those on middle of back smallest and most distinct, those at sides larger and tending to become confluent. Sides pale cream-buff with faint dark shading, this colour passing rather abruptly into bright buff of chest, belly, and inner surface of hind legs. Chin, throat, and under side of neck as far as fore legs like sides but still paler, rather sharply contrasted with colour of belly. Muzzle, cheeks, eye-ring (about 2 mm. wide) and ill defined area extending behind eye nearly to ear, cream-buff. Crown and stripe 5 mm. wide below eye russet sprinkled with cream-buff. Feet pale cream-buff; heel and ankle clear russet. Tail a dull buffy russet below, fringed with cream-buff, a grizzle of blackish and cream-buff above.

Skull and teeth.—The only skull examined is imperfect. It is smaller than that of *C. citellus*, and apparently less deep at middle, though dorsal profile is similarly convex throughout. Rostrum narrower and not so deep as in *C. citellus*, but not peculiar in form. Incisive foramina reduced to mere slits barely 5 mm. in width, and so short that their length is scarcely equal to diameter of alveolus of upper incisor. Palate and interorbital region narrower than in *C. citellus*, but interorbital breadth greater than breadth of rostrum. Mandible smaller and less robust than that of the related species but not peculiar in form. The teeth do not differ appreciably from those of *C. citellus*.

Measurements.—Adult female from Galicia, Hungary (from well-made skin): head and body, 200; tail, 40; hind foot, 32; ear, 7. For cranial measurements see Table opposite.

Specimen examined.—One, from Galicia, Hungary.

1. Galicia; Hungary. Purchased (Prulière). 86. 4. 2. 2.

Genus **MARMOTA** Blumenbach.

1777. *Glis* Erxleben, Syst. Regni Anim., I, p. 358 (part). Not *Glis* Brisson, 1762.
1779. *Marmota* Blumenbach, Handb. der Naturgesch., I, p. 79 (*alpina* = *marmota*).
1780. *Arctomys* Schreber, Säugethiere, pl. CCVII (*alpina* = *marmota*).
1780. *Lagomys* Storr, Prodr. Meth. Mamm., p. 39 (Renaming of *Arctomys*).
1811. *Lipura* Illiger, Prodr. Syst. Mam. et Avium, p. 95 (*hudsonius* = *monax*).
1857. *Arctomys* Blasius, Säugethiere Deutschlands, p. 278.
1904. *Marmota* Trouessart, Catal. Mamm. Viv. Foss., Suppl., p. 343. Frisch (Natursystem der vierfüss. Thiere, 1775, p. 9), cited as authority, but this writer not binary (see Thomas and Miller, Ann. and Mag. Nat. Hist., 7th ser., xvi, pp. 461–464, October, 1905).

Type species.—*Marmota alpina* Blumenbach = *Mus marmota* Linnæus.

Geographical distribution.—Northern Hemisphere from the

Alps eastward through Asia and North America to the Atlantic coast of the United States.

Characters.—Strictly terrestrial *Sciuridæ*, including the largest members of the family; form robust, Meline rather than Sciurine in general aspect; tail short and bushy, scarcely or not flattened; cheek pouches rudimentary or absent; cranial and dental characters essentially as in *Citellus*, but skull with rostrum nearly as deep as brain-case, and with heavy postorbital processes standing out nearly at right angles with main axis of skull; anterior upper premolar always large and well developed.

Remarks.—About two dozen species of *Marmota* are now known, the majority of them occurring in Central Asia. One of these extends its range westward into eastern Hungary; while a single species is peculiar to the Alps and Carpathians.

KEY TO THE EUROPEAN SPECIES OF *MARMOTA*.

Colours noticeably varied, the head blackish, with contrasted pale muzzle, the back much less yellowish than sides, the tail conspicuously black on terminal third; skull with posterior border of postorbital process decidedly in front of narrowest portion of postorbital constriction (Alps and Carpathians) ..... *M. marmota*, p. 932.

Colours not varied, the entire animal a yellowish brown overlaid on upper parts with black, the head slightly darker than body, without contrasted pale muzzle, the tail inconspicuously blackish at tip; skull with posterior border of postorbital process nearly over narrowest portion of postorbital constriction (eastern Hungary) ... *M. bobak*, p. 937.

MARMOTA MARMOTA Linnæus.

1758. [*Mus*] *marmota* Linnæus, Syst. Nat., I, 10th ed., p. 60.

1779. [*Marmota*] *alpina* Blumenbach, Handb. der Naturgesch., I, p. 80 (Substitute for *Marmota*).

1801. *A[rctomys] m[armota] tigrina* Bechstein, Gemeinn. Naturgesch. Deutschlands, I, 2d ed., p. 1029.

1801. *A[rctomys m[armota] alba* Bechstein, Gemeinn. Naturgesch. Deutschlands, I, 2d ed., p. 1030.

1801. *A[rctomys] m[armota] nigra* Bechstein, Gemeinn. Naturgesch. Deutschlands, I, 2d ed., p. 1030.

1857. *Arctomys marmota* Blasius, Säugethiere Deutschlands, p. 280.

1904. [*Marmota*] *marmotta* Trouessart, Catal. Mamm. Viv. Foss., Suppl., p. 343.

1910. *Marmota marmota* Trouessart, Faune Mamm. d'Europe, p. 129.

Type locality.—Alps.

Geographical distribution. Alps and Carpathians. Frequently referred to as occurring in the Pyrenees, but this probably an error.*

Diagnosis. Size medium (head and body about 550, tail

* *See* Trutat, Bull. Soc. d'Hist. Nat. de Toulouse, XI, p. 110, 1877.

about 150, hind foot about 93 mm. ; condylobasal length of fully adult skulls. 92 to 98 mm.) ; colours noticeably varied, the head usually blackish with contrasted pale muzzle and cheeks, the back blackish or greyish, the shoulders, sides and underparts tawny or yellowish, the tail with extensive black terminal area ; skull somewhat elongate, the postorbital processes standing so far forward that their hinder border is decidedly in front of narrowest portion of postorbital constriction ; anterior face of incisors deep orange.

External characters.—Form heavy and badger-like, the legs short and muscular, the tail about one-third as long as head and body, densely haired but not flattened, the head short, with inconspicuous ears and rather broad, rounded muzzle. Ear shorter than adjacent fur, its general outline rounded, but with a slight backward projection above ; when laid forward the extremity extends less than half way to eye. Muzzle pad bare at middle, its outline not sharply defined above, the naked area extending downward as a narrow line across upper lip, and outlined on each side by a deep groove running downward from corresponding nostril. Feet robust, with long, slightly curved fossorial claws, those of fore feet somewhat the better developed ; fore foot with no trace of pollex or its nail,* the third digit decidedly longer than the others, the fourth, second and fifth successively shorter ; palm naked, with three confluent pads at base of digits, and two larger, rounded pads occupying posterior half of palm, that on inner side somewhat projecting ; hind foot with third digit slightly longer than the sub-equal third and fourth, the fifth and first successively much shorter ; hallux well developed, extending to middle of first phalanx of second digit, its claw like those of other toes but slightly smaller ; sole naked except at heel ; four sub-equal, partly confluent pads at base of digits, immediately behind these two smaller tubercles, that of inner side smallest. Mammæ : $p\ 1-1$; $a\ 2-2$; $i\ 2-2=10$.

Colour.—Upper parts a grizzle of black and light buff, the exact proportions of the two sufficiently variable to produce considerable individual differences in the general effect, but top of head usually blackish finely ticked with whitish buff in evident contrast with less dark neck, and back behind shoulders usually darker than region in front ; underfur of back slaty black at base, the tips of the hairs forming a buffy or greyish band about 7 mm. wide ; when this band is conspicuously grey it imparts to dark area of back a peculiar metallic sheen or lustre ; muzzle nearly to level of front of eye whitish or buffy in abrupt contrast with dark crown ; cheeks a coarse grizzle of blackish and buffy white ; underparts and inner surface of legs a clear yellowish tawny-buff, this colour suffusing outer surface of legs and sides of body, also a conspicuous area extending upward immediately behind shoulder and partly separating dark

* Verified in twenty skins.

region of neck from that of back; feet buff, somewhat lighter than outer surface of legs; tail black or blackish brown, suffused to a varying degree with buff, the light colour most conspicuous at and near base.

Skull.—Apart from its much greater size the skull of *Marmota marmota* resembles that of *Citellus citellus* in most of its more essential features. The depth at front of brain-case and in interorbital region is relatively less, and in adult individuals there is a well developed sagittal crest on posterior half of brain-case, with the result that dorsal profile while equally convex in

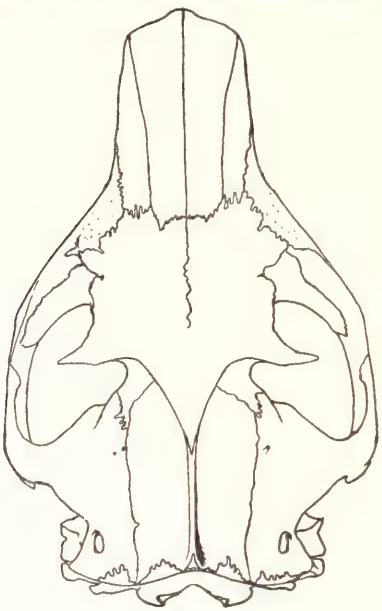


FIG. 190.

Marmota marmota. Slightly reduced.

front is noticeably flattened posteriorly as compared with the smaller animal. Ventral profile with no special peculiarities. Outline of brain-case somewhat obscured by the enlarged squamosals, the area of which, when skull is viewed from above, considerably exceeds that of parietals; constriction in front of lambdoid region relatively wider and more evident than in *Citellus citellus*. Lambdoid crest high, sometimes projecting backward sufficiently to conceal occipital region in dorsal view. Occiput lower relatively to its width than in *C. citellus*, the arch slightly pointed at middle and essentially as high as middle

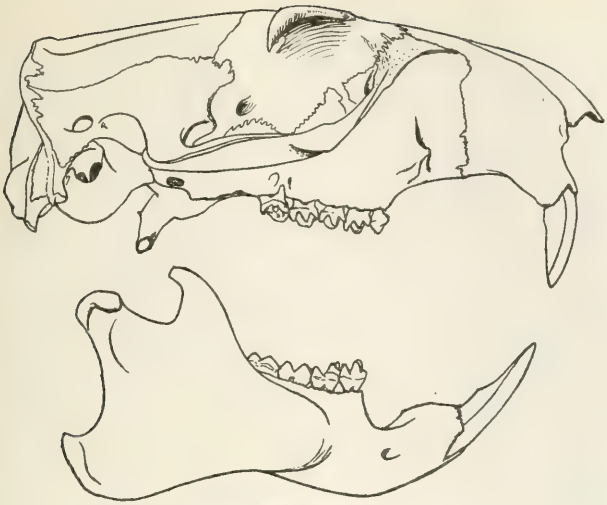


FIG. 191.
Marmota marmota. Slightly reduced.

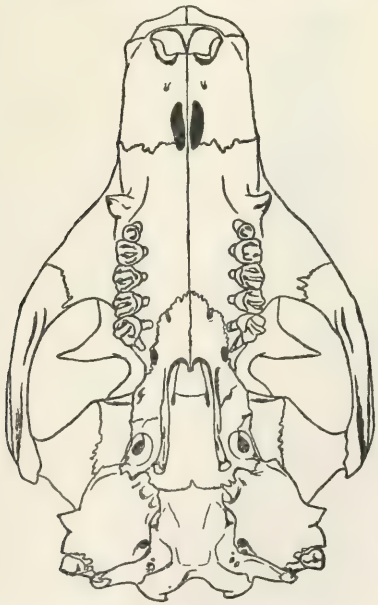


FIG. 192.
Marmota marmota. Slightly reduced.

of brain-case; paroccipital process robust, not very long, its extremity projecting slightly beyond level of lower edge of condyle; basioccipital broad and short, its lateral processes very distinct; auditory bulla moderately large, evenly inflated, the region below meatus constricted to form a short but evident neck. Interorbital region broad, squarish, the median portion depressed; postorbital processes heavy, standing out abruptly, not much bent downward, separated from brain-case by a wide space; orbit about two-thirds surrounded by bone. Nasals abruptly bent downward anteriorly, considerably narrowed posteriorly, so that their combined breadth at level of posterior border of premaxillaries is only a little more than half greatest anterior breadth. Incisive foramina extending back slightly into maxillaries, their outer borders nearly parallel. In other respects the skull so closely resembles that of *Citellus citellus*, due allowance being made for its greater size and angularity, as to require no detailed description.

Teeth.—In general form the teeth bear a strong resemblance to those of *Citellus citellus*. Upper incisor with anterior face slightly flattened, somewhat distorting the otherwise evenly semicircular outline of cross-section, the enamel deep yellowish brown, its surface marked by about four faintly indicated longitudinal ridges; enamel of lower incisor minutely pitted. Enamel pattern of upper cheek-teeth essentially as in *Citellus citellus*, but inner tubercles lower and less compressed, the length of base slightly greater than height of tubercle, transverse ridges forming a V-shaped rather than U-shaped figure when worn, and anterior and posterior ridges continuous at their inner extremities with anterior and posterior bases of inner tubercle. Other details in which the upper cheek-teeth differ from those of *C. citellus* are as follows: no indication of minute secondary cusps or ridges between main cusps of outer side; small premolar with crown area barely half that of succeeding tooth, its anterior and posterior depression tending to join on inner side to form a narrow semicircular concavity; depression on posterior half of m^3 flattened rather than basin-shaped. Lower cheek-teeth differing from those of *Citellus citellus* in their relatively much lower, more robust cusps and larger crushing surfaces, and the relatively greater importance of ridge joining inner bases of outer cusps, this ridge so high that it begins to wear almost as soon as the cusps themselves, forming a conspicuous feature of

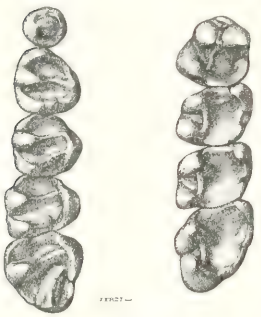


FIG. 193.

Marmota marmota. Cheek-teeth. × 2.

the enamel pattern ; premolar with a small but evident cingulum cusp on anterior border.

Measurements.—Adult male from Barcelonnette, Basses-Alpes, France: head and body, 577 ; tail, 153 ; hind foot, 94 ; ear, 30. Adult male and female from Canton St. Gallen, Switzerland: head and body, 540 and 530 ; tail, 159 and 150 ; hind foot, 90 and 87. Two adult males from Grisons, Switzerland: head and body, 503 and 530 ; tail, 130 and 160 ; hind foot, 90 and 95. For cranial measurements see Table, p. 939.

Specimens examined.—Forty-seven, from the following localities:—

France: Near Barcelonnette, Basses-Alpes, 8 (B.M. and Mottaz).

Switzerland: Salanfe (at foot of Dent du Midi), Valais, 1 (Mottaz); Meiringen, Bern, 2; Engstlen Alp, Unterwalden, 1; Engelberg, Unterwalden, 1 (U.S.N.M.); Schaufigg, Grisons, 3; Canton Grisons (no exact locality), 4 (U.S.N.M.); Rheinwaldhorn, Grisons, 1.

Italy: Vagna Valley, near Mte. Rosa, Novara, 1 (Genoa); Aosta Valley, Turin, 20 (Turin): Argentera, Cuneo, 3 (Turin); Maritime Alps, 1 (Genoa).

Austria-Hungary: Felkaerthal, Tatra Mountains, Hungary, 1.

2 ♂, 2 ♀.	Barcelonnette, Basses-Alpes, France. (*C. Mottaz.*)	O. Thomas (P).	8. 8. 10. 145. 63–65.
Skull.	Meiringen, Bern, Switzerland. (*Koeserman.*)	Tomes Collection.	7. 1. 1. 195.
1.	Engelberg, Unterwalden. (*Koeserman.*)	Tomes Collection.	7. 1. 1. 131.
♂, 2 ♀.	Schaufigg, Grisons. (*Zollikofer.*)	O. Thomas (P).	2. 8. 4. 31–33.
♂.	Rheinwaldhorn, Grisons. (*Zollikofer.*)	O. Thomas (P).	2. 8. 4. 30.
1.	Felkaerthal, Tatra Mountains; Hungary.	Poprad Museum (E).	7. 4. 19. 1.

MARMOTA BOBAK Müller.

1776. *Mus bobak* P. L. S. Müller, Natursyst. Suppl. u. Regist.-Band, p. 40 (Poland).

1778. *Mus arctomys* Pallas, Nov. Sp. Quadr. Glir. Ord., p. 75 (Poland).

1780. *Arctomys bobac* Schreber, Säugethiere, pl. ccix (description, iv, p. 738, 1782). Renaming of *Mus arctomys.*

1811. *Arctomys baibac* Pallas, Zoogr. Rosso-Asiat., p. 155 (Poland).

1857. *Arctomys bobac* Blasius, Säugethiere Deutschlands, p. 283.

1904. [*Marmota*] *bobac* Trouessart, Catal. Mamm. Viv. Foss., Suppl., p. 343.

1910. *Marmota bobac* Trouessart, Faune Mamm. d'Europe, p. 129.

Type locality.—Poland.

Geographical distribution.—From Poland and eastern Hungary (Galicia and Bukowina) eastward into Asia. Exact limits of range not known.

Diagnosis.—Size essentially as in *Marmota marmota ;* colours uniform, the entire animal a yellowish brown overlaid on upper parts with black, the head slightly darker than body, without contrasted pale muzzle or cheeks, the tail blackish at extreme tip only ; skull relatively broader than in *M. marmota,* and post-orbital processes standing so far back that their hinder border is nearly over narrowest portion of postorbital constriction ; teeth

somewhat heavier than those of *M. marmota*, especially the lower molars; anterior face of incisors whitish or pale orange.

External characters.—Essentially as in *Marmota marmota*, but thumb present as a small though distinct tubercle bearing an evident appressed nail. Mammæ: $p\ 2-2$, $a\ 2-2$, $i\ 1-1=10$.

Colour.—Entire animal a light yellowish brown, the head suffused with a darker brown, the back, sides of body and outer surface of limbs clouded with blackish hair-tips, these most numerous over posterior half of back, but nowhere obscuring the

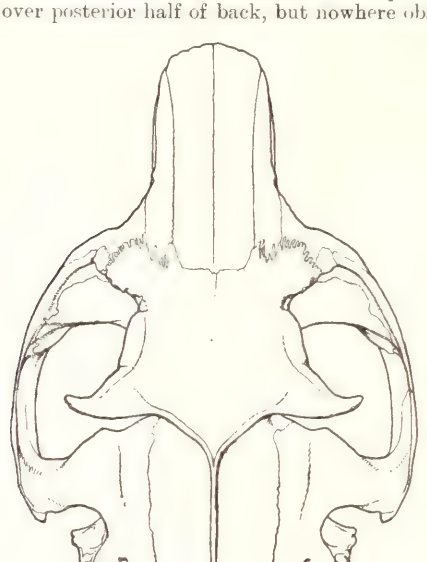


FIG. 194.
Marmota bobak. Slightly reduced.

ground colour; feet a clear yellowish brown; underparts and inner surface of limbs like back but slightly darker and more tawny, the hairs without blackish tips; tail essentially similar, the extreme tip dark brown or blackish; underfur everywhere dull yellowish, the hairs with slaty bases.

Skull and teeth. The skull, though of about the same length as that of *Marmota marmota*, is broader and more robust in general form, and all ridges for muscular attachment are more prominent. Nasals less abruptly bent downward anteriorly and less narrowed posteriorly, their combined breadth at level of

CRANIAL MEASUREMENTS OF *MARMOTA MARMOTA* AND *M. BOBAK*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Rostral breadth over canines.	Interorbital constriction.	Postorbital constriction.	Mastoid breadth.	Occipital depth.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
M. marmota.															
France: Barcelonnette, Basses-Alpes	8. 8. 10. 145	♂	87·6	55·6	18·6	24·8	18·8	39·6	24·8	37·8	22·4	61·2	22·4	19·8	Teeth slightly worn.
,, ,,	8. 8. 10. 63	♂	91·4	56·8	19·0	25·0	18·8	41·4	26·0	39·6	24·0	64·0	22·4	20·4	,, ,,
,, ,,	Co. 109 Mottaz	♂	85·0	52·0	18·0	22·4	17·6	38·2	24·0	35·0	22·0	59·6	21·6	20·8	,, ,,
,, ,,	5689 Mottaz		98·0	61·2	21·2	28·8	18·2	43·8	27·8	43·0	25·2	69·8	22·4	20·4	,, much worn.
,, ,,	Co. 110 Mottaz	♀	86·0	53·0	18·4	23·0	17·6	39·6	24·6	36·0	23·0	61·0	21·8	20·8	,, slightly worn.
,, ,,	8. 8. 10. 64	♀	92·0	57·4	20·4	27·0	18·4	42·0	26·0	37·6	24·2	64·6	22·0	19·4	,, much worn.
,, ,,	8. 8. 10. 65	♀	93·0	59·0	20·0	—	18·0	42·6	26·6	—	24·6	65·0	22·2	20·0	,, ,,
Switzerland: Meiringen, Bern	7. 1. 1. 195		96·6	62·0	20·0	26·0	18·0	43·0	26·0	40·0	26·0	67·0	22·6	21·4	,, slightly worn.
,, ,,	7. 1. 1. 195*bis*		95·0	62·2	20·6	29·4	19·6	43·4	27·0	41·0	26·6	—	22·0	—	,, ,,
Canton St. Gallen	115221	♂	95·0	63·2	20·8	29·6	18·8	42·8	27·8	40·8	25·8	68·6	22·0	19·8	,, much worn.
Schaufigg, Grisons	2. 8. 4. 32	♀	94·0	60·6	21·0	27·2	19·0	41·4	25·4	39·6	24·4	—	22·6	—	,, slightly worn.
,, ,,	2. 8. 4. 33	♀	95·0	61·6	20·4	27·4	19·6	42·4	26·8	41·4	25·6	69·6	23·0	22·0	,, ,,
Grisons, no exact locality	115219	♂	96·6	60·8	20·6	29·6	19·6	44·2	27·0	40·4	26·2	67·8	21·2	19·8	,, moderately worn.
,, ,,	115220	♂	90·8	57·8	18·8	25·2	18·2	40·4	26·2	37·8	23·8	65·2	21·0	19·4	,, slightly worn.
,, ,,	115222	♂	93·0	62·2	20·2	28·2	19·0	42·8	26·0	39·2	24·2	64·6	21·4	20·2	,, moderately worn.
Rheinwaldhorn, Grisons	2. 8. 4. 30	♂	96·0	61·0	20·0	26·0	19·0	43·8	26·6	42·0	27·0	67·0	22·4	20·4	,, slightly worn.
M. bobak.															
Russia: no exact locality	46. 2. 2. 1		97·0	65·2	19·2	25·2	15·8	46·6	29·0	39·8	25·2	71·4	23·0	22·6	,, moderately worn.
,, ,,	46. 2. 2. 21		97±	64·8	20·6	25·0	15·8	45·6	—	42·6	27·2	70·8	23·0	22·6	,, much worn.

posterior border of premaxillary fully three-fourths greatest combined breadth anteriorly. Orbit larger than in the related species, the postorbital process situated so far back that its tip lies over a point decidedly behind middle of temporal fossa instead of over middle, and its posterior border nearly overhangs deepest part of postorbital constriction and anterior border of squamosal. Brain-case noticeably broader in proportion to its length, and foramen magnum wider relatively to its height. Auditory bullæ larger than in *Marmota marmota*, the area of each bulla appearing greater than that of basioccipital and condyles instead of about equal to it. Palate relatively narrower posteriorly, and incisive foramina wider in proportion to their length than in *M. marmota*. Mandible more robust than in the related animal, especially in front; sigmoid flexure longer and less concave.

Teeth essentially as in *Marmota marmota* as regards form, but anterior surface of incisors pale yellowish instead of deep orange, and cheek-teeth more robust, a character especially noticeable in second and third lower molars.*

Measurements.—Male and female from Russia (skins): head and body, 600 and 530; tail, 190 and 160; hind foot, 90 and 89. For cranial measurements see Table, p. 939.

Specimens examined.—Two, both from Russia.

Family PETAURISTIDÆ.

1855. *Pteromyinæ* Brandt, Mém. Acad. Imp. Sci., St. Petersburg, 6th ser., Sci. Nat., VII, p. 151.

1857. *Sciurina* Blasius, Säugethiere Deutschlands, p. 266 (part).

1879. *Pteromidæ* Anderson, Anat. and Zool. Researches, Expeds. Yunnan, p. 278.

1891. *Sciurinæ* Flower and Lydekker, Mammals, living and extinct, p. 450 (part).

Geographical distribution.—Wooded portions of Northern Hemisphere south to the Malay region and the southern United States. In Europe confined to Scandinavia and northern Russia.

Characters.—Like the *Sciuridæ*, but with fore and hind limbs connected by a broad fold of skin extending to wrists and ankles, supported anteriorly by a stiff cartilaginous process growing from wrist, the membrane serving as a parachute by means of which gliding flight is effected.

Remarks.—The *Petauristidæ* are so sharply differentiated from the *Sciuridæ*, that it seems preferable to recognize the two groups as families. Eight genera are known,† one of which is represented in Europe.

* This difference between the teeth of *M. marmota* and *M. bobak* is of much importance in determining the identity of subfossil remains.

† See Thomas, Ann. and Mag. Nat. Hist., 8th ser., I, pp. 1–8, January, 1908.

Genus SCIUROPTERUS F. Cuvier.

1825. *Sciuropterus* F. Cuvier, Dents des Mammifères, p. 255.
1857. *Pteromys* Blasius, Säugethiere Deutschlands, p. 268.

Type species.—*Sciurus volans* Linnæus = *Pteromys russicus* Tiedemann.

Geographical distribution.—As in the family.

Characters.—No membrane extending between tail and hind leg; structure of molars essentially as in *Sciurus*, the enamel not thrown conspicuously into wrinkles, the transverse ridges well developed; posterior upper premolar about as large as first molar, never decidedly smaller.

Remarks.—The genus *Sciuropterus* as thus defined contains about thirty species, most of them Malayan. It is divided into four sub-genera, to one of which (*Glaucomys*) belong all the American members of the family. The single European representative of the group is the type of the sub-genus *Sciuropterus*, the three or four other known members of which occur in central and northern Asia and in Japan.

SCIUROPTERUS RUSSICUS Tiedemann.

1758. [*Sciurus*] *volans* Linnæus, Syst. Nat., I, 10th ed., p. 64 (Sweden). Not *Mus volans* Linnæus, *l.c.*, p. 63.
1808. *P*[*teromys*] *russicus* Tiedemann, Zoologie, I, p. 451 (Russia).
1822. *Pteromys sibiricus* Desmarest, Mammologie, II, p. 342 (Substitute for *volans*).
1843. *Pt*[*eromys*] *vulgaris* Wagner, Schreber's Säugthiere, Suppl., III, p. 228 (Substitute for *volans*).
1857. *Pteromys volans* Blasius, Säugethiere Deutschlands, p. 269.
1903. *Sciuropterus russicus* Allen, Bull. Amer. Mus. Nat. Hist., XIX, p. 132. March 31, 1903.
1910. *Sciuropterus russicus* Trouessart, Faune Mamm. d'Europe, p. 116.

Type locality.—Russia.

Geographical distribution.—Wooded portions of northern Siberia and Russia, southward nearly to the boundary of northeastern Germany, eastward into northern Scandinavia.

Diagnosis.—Size median (head and body about 170 mm., tail about 110, hind foot about 33, condylobasal length of skull about 37); colour of upper parts a light silvery or buffy grey; skull with nasals abruptly constricted just behind middle, not narrowing gradually backward; auditory bulla very large, its greatest antero-posterior diameter equal to distance between bulla and anterior portion of first molar.

External characters.—Form not essentially different from that of *Sciurus vulgaris*, but appearing broadened and flattened on account of the more depressed tail and the wide flying membrane. Head short and round; eyes very large; ear low, rounded, almost concealed in the fur, the outer margin faintly concave

above, both surfaces clothed with fine short hairs which never form tuft at tip. Feet relatively shorter and broader than in *S. vulgaris*, the digits much less graduated, particularly those of hind foot, the claws rather short, strongly curved, very acutely pointed, those of hind foot nearly concealed by tufts of curved hairs lying over them : front foot with fourth digit longest, third, fifth and second successively shorter, supporting cartilage about twice as long as foot, thumb an inconspicuous tubercle with rudimentary flattened nail ; hind foot with three middle digits sub-equal and longest, first extending to base of claw of second, fifth a little beyond base of first phalanx of fourth ; palmar and plantar tubercles bare, arranged as in *S. vulgaris*, their size relatively smaller ; palms thinly haired between pads, soles with dense growth of long woolly hairs especially conspicuous along inner side and adding much to apparent width of foot. Fur of a peculiar silky texture, noticeably softer and more dense than in *S. vulgaris*, this particularly marked in the broad, much flattened tail ; hairs along anterior edge of membrane (in region of supporting cartilage) noticeably stiffened.

Colour.—Upper parts a uniform pale, silvery grey, with a faint buffy cast, the slaty under colour appearing irregularly at surface when hairs are disarranged, particularly near outer edge of lateral membrane, and on feet : everywhere there is a very faint suggestion of dark "lining," produced by the presence of black-tipped longer hairs : cheeks paler and less buffy than crown ; a narrow blackish eye-ring ; underparts and inner surface of limbs dull buffy white, everywhere inconspicuously sprinkled with blackish hairs ; tail more buffy than body (nearly the cream-buff of Ridgway), the upper and lower surfaces and the tip much clouded with dusky, the sides almost clear.

Skull. As compared with that of *Sciurus vulgaris* the skull is much smaller, but at the same time with all lines more exaggerated, it might almost be said distorted, and contrasts more abrupt. Profiles essentially as in *Sciurus vulgaris*, but nasals abruptly curved downward at tip, occiput slightly concave owing to the more posterior position of condyles and paroccipital processes due to enlargement of bullæ, and ventral profile more nearly parallel with dorsal profile, its posterior portion carried further downward by the large bullæ. Brain-case squarish in general outline when viewed from above, its posterior margin broadly and evenly rounded, its width posteriorly about double that of postorbital constriction : surface essentially smooth, though a faint ridge may usually be traced diagonally across each side of parietal, the ridges curving inward posteriorly and meeting in median line somewhat in front of lambdoid region ; in old individuals a tubercular projection is developed on edge of temporal fossa at antero-external corner of parietal, much as in *Lepus ;* lambdoid crest low and rounded ; viewed from the side the brain-case is more depressed than in *Sciurus vulgaris*, so that

less of the surface of parietal is visible; occiput very low, its height above lower lip of foramen magnum about one-half mastoid breadth, its dorsal and lateral margins forming a flattened curve much less than a semicircle in extent; foramen magnum decidedly wider than high; surface of occipital with very obscure swellings between foramen magnum and lambdoid ridge; paroccipital processes very slender; basioccipital rather narrow and long, its width anteriorly about one-half median length, its lateral ridges obsolete, not tending to form processes as in *Sciurus vulgaris* and *Citellus;* auditory bullæ sub-circular in general outline, their form essentially as in *Sciurus vulgaris*, but their

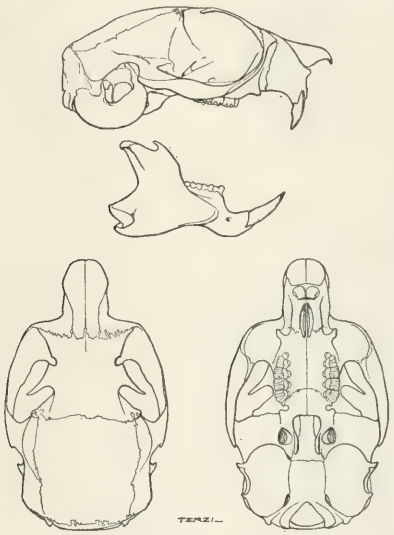


FIG. 195.
Sciuropterus russicus. Nat. size.

size actually as well as relatively greater, the antero-posterior diameter equal to distance from front of bulla to front of m^1, the lateral diameter to outer margin of meatus fully $1\frac{1}{2}$ times least width of basioccipital; anterior upper margin of meatus developed into a conspicuous forward-curved flange; petrosal tending to be exposed in region above meatus instead of on occipital surface. Interorbital region decidedly longer than broad, its surface noticeably concave laterally, so that bases of postorbital processes are evidently above level of median region; notch at anterior base of postorbital process large, always open; postorbital processes long and slender, strongly curved downward, the orbit

actually as well as relatively larger than in *Sciurus vulgaris*, and less well defined posteriorly owing to absence of distinct anterior concavity and median projection on upper border of zygoma, its orifice directed more upward. Zygoma no more abruptly spreading than in *Sciurus vulgaris*, but the arches appearing wider by contrast with the narrower interorbital region, and also on account of the much more abrupt angle at which the anterior surface of zygomatic root meets outer surface of rostrum; median portion of arch splayed so strongly outward as to be almost horizontal; jugal projecting posteriorly behind zygomatic process of squamosal, its upper border without angular median projection, its anterior extremity running upward nearly to lachrymal; anteorbital foramen small, nearly circular, scarcely in front of level of anterior premolar, hidden in lateral view by the conspicuously projecting process formed by lower portion of its outer border. Rostrum relatively somewhat shorter than in *Sciurus vulgaris*, its base so narrow that its sides are nearly parallel, the least depth behind incisors somewhat greater than width in same region; nasals rather short, abruptly narrowed posteriorly, their slightly emarginate hinder border lying at level of posterior base of zygomatic root, the moderately expanded nasal branches of premaxillaries scarcely extending behind them. Palate relatively about as wide as in *Sciurus vulgaris;* incisive foramina large but lying almost entirely within premaxillaries, the posterior border of which is therefore relatively much further back (under middle of zygomatic root) than in *Sciurus vulgaris*, the greatest length of foramina exceeding least width of rostrum and equal to somewhat more than half diastema; region behind notch back of m^3 conspicuously thickened; mesopterygoid space about as long as in *Sciurus vulgaris*, but conspicuously wider anteriorly than posteriorly. Mandible with anterior portion of ramus less deepened and more curved than in *Sciurus vulgaris;* posterior region so deep and short that greatest depth (exclusive of coronoid) is nearly equal to distance from condyle to front of m_1, while in *S. vulgaris* the same depth barely equals distance from condyle to back of m_1; coronoid process low and short, strongly curved backward; angular process large, its broad apex curving abruptly outward, its lower border greatly developed and forming almost a separate lobe bent strongly inward.

Teeth.—Incisors less compressed than those of *Sciurus vulgaris*, the roots forming no evident protuberances, the anterior surface smooth, deep orange in colour. Anterior upper premolar terete, its crown simple, about one-fourth or one-fifth that of succeeding tooth in area. Upper molariform teeth resembling those of *Sciurus vulgaris* in their relative sizes and general structure; anterior border of crown more elevated, its outer extremity appearing as a distinct cusp nearly as high as the two main cusps when tooth is viewed from the side; main transverse ridges relatively higher and narrower, the second, except in m^3,

cut by a deep posterior re-entrant fold, so that its inner extremity stands as a nearly free subterete cusp; inner cusp relatively higher, obscurely trilobed owing to the presence on palatal border of two well marked depressions extending from apex nearly to base of crown (these become obsolete as the tooth wears away); in m^1, m^2 and m^3, a short process extends outward from base of inner cusp into space between first and second transverse ridges, while in pm^4, m^1 and m^2 a similar but less developed process lies in space between second and third ridges; third and fourth ridges of m^3 smaller than in the other teeth, but well developed, so that there is no indication of a posterior basin-shaped area on surface of crown. Mandibular teeth like those of *Sciurus vulgaris* in relative sizes and in general form except that m_3 is longer and more narrowed posteriorly. The pattern of enamel folding, while essentially like that of *S. vulgaris* in its main features, is more complicated, owing to the greater development of all the smaller cusps and folds; main cusps relatively higher and more slender, their bases extending further inward toward middle of crown, this together with the greater development of cusp and ridge connecting inner portion of bases of outer main cusps greatly reducing area of median crushing surface, which is scarcely basin-shaped and which occupies less than half area of crown; antero-external ridge well developed in the three molars, terminating in a distinct cusp-like elevation at middle of anterior border of crown; a deep depression at anterior base of postero-external cusp; a similar but larger depression behind base of postero-internal cusp of m_3, the cinguium rising back of it so as almost to form a supplemental cusp.

FIG. 196.

Sciuropterus russicus.
Cheek-teeth. × 5.

Measurements.—Adult male from Finland: head and body, 170; tail, 109; hind foot, 35; ear, 19. A second adult from the same region: tail, 128; hind foot, 37. For cranial measurements see Table, p. 946.

Specimens examined.—Two from Finland (B.M. and U.S.N.M.); also one from Russia, and a stuffed specimen from unknown locality.

1.	Finland.	Dr. H. Schulman (P).	1. 6. 9. 1.
1.	Russia.	Purchased (Parzudaki).	53. 12. 6. 29.
1 st.	Europe.	Purchased (Brandt).	42. 5. 16. 41.

CRANIAL MEASUREMENTS OF *SCIUROPTERUS RUSSICUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Mastoid breadth.	Postorbital constriction.	Interorbital constriction.	Rostral breadth at front of lateals.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
Finland .	1. 6. 9. 1	♂	36·2	21·2	19·0	9·4	9·0	6·8	12·8	8·2	23·2	7·4	7·2	Teeth moderately worn.
Russia .	53. 12. 6. 29		36·8	21±	18·8	9·0	8·4	6·4	13·2	8·2	23·2	7·2	7·2	,, ,,

Family CASTORIDÆ.

1821. *Castoridæ* Gray, London Med. Repos., xv, p. 302, April 1, 1821.

Geographical distribution.—Forested portions of the Northern Hemisphere, south to the Mediterranean region and the southern United States.

Characters.—Essentially as in the *Sciuridæ*, but skull without postorbital processes, and cheek-teeth rootless, with re-entrant enamel folds; premolars $\frac{1}{1}$; angular portion of mandible short, broadly rounded; size large; form heavy; tail broad, flattened from above downwards, its surface scaly; habits aquatic.

Remarks.—Though several extinct members of the group are known the family *Castoridæ* is represented by only one living genus, widely distributed in the northern portion of both the Old and New Worlds.

Genus **CASTOR** Linnæus.

1758. *Castor* Linnæus, Syst. Nat., i, 10th ed., p. 58 (*fiber* by tautonymy).
1806. *Fiber* Duméril, Zoologie Analytique, p. 18, diagnosis on p. 19. (Substitute for *Castor*.) Not *Fiber* Cuvier, 1800.

Type species.—*Castor fiber* Linnæus.

Geographical distribution.—As in the family.

Characters.—General characters as in the family; upper molars sub-equal, each with one internal and three external enamel folds.

Remarks.—The genus *Castor* is the only living representative of the family. It contains two closely related species, one peculiar to North America, the other to the northern portions of the Old World.

CASTOR FIBER Linnæus.

1758. [*Castor*] *fiber* Linnæus, Syst. Nat., i, 10th ed., p. 58 (Sweden).
1792. *C*[*astor*] *f*[*iber*] *albus* Kerr, Anim. Kingd., p. 222.
1792. *C*[*astor*] *f*[*iber*] *solitarius* Kerr, Anim. Kingd., p. 224.
1801. *C*[*astor*] *f*[*iber*] *variegatus* Bechstein, Gemeinn. Naturgesch. Deutschlands, i, 2d ed., p. 913 (Europe).
1801. *C*[*astor*] *f*[*iber*] *fulvus* Bechstein, Gemeinn. Naturgesch. Deutschlands, i, 2d ed., p. 913 (Europe).
1803. *Castor galliæ* Geoffroy, Catal. Mamm. du Mus. Nat. d'Hist. Nat., Paris, p. 168 (Banks of the Rhone, France).
1822. *Castor niger* Desmarest, Mammalogie, pt. ii, p. 278 (no exact locality).
1822. *Castor varius* Desmarest, Mammalogie, pt. ii, p. 278 (northern and central Europe).
1822. *Castor flavus* Desmarest, Mammalogie, pt. ii, p. 278 (no exact locality).
1829. [*Castor fiber*] β. *gallicus* Fischer, Synops. Mamm., p. 287 (Substitute for *galliæ*).

1833. *Castor proprius* Billberg, Linn. Samf., p. 34 footnote (Substitute for *fiber*).

1857. *Castor fiber* Blasius, Säugethiere Deutschlands, p. 405.

1897. *Castor fiber* Collett, Bergens Museums Aarbog, pp. 3-127. Habits in Norway.

1907. *Castor albicus* Matschie, Sitz.-Ber. Gesellsch. Naturforsch. Freunde, Berlin, p. 216, October, 1907. (Dessau, Anhalt, Germany.) See Lönnberg, Arkiv för Zoologi, v, no. 6, pp. 1–16, 1909.

1907. ? *Castor vistulinus* Matschie, Sitz.-Ber. Gesellsch. Naturforsch. Freunde, Berlin, p. 219, October, 1907 (western Poland).

1910. *Castor fiber* Trouessart, Faune Mamm. d'Europe, p. 130.

Type locality.—Sweden.

Geographical distribution. Formerly the entire forested region of Europe, west to Great Britain; now exterminated everywhere except in portions of Scandinavia, and along the courses of some of the larger rivers of central Europe, as the Rhone, Elbe, and Danube.

Diagnosis. General features as in the family and genus: posterior extremity of nasals lying at or slightly behind level of middle of orbit and decidedly behind termination of nasal branches of premaxillaries; least depth of rostrum behind incisors not equal to distance from gnathion to anteorbital foramen.

External characters. General form heavy and thick-set, the head large and rounded, the eyes and ears small, the legs short, the feet large; the tail somewhat less than half as long as head and body, its width about one-third its length. Head short, deep and rounded, the eye small, about midway between ear and nostril; ear low and rounded, densely haired on both surfaces, scarcely appearing above the surrounding fur; meatus small but apparently without any specially developed valves; muzzle pad mostly naked, but with fur encroaching on its posterior border and along inner margin of nostril; below pad the lip is less densely haired than elsewhere, and the hairs tend to converge along median line; whiskers very coarse and bristly, the longest extending a little beyond eye when laid back. Front foot with no special peculiarities, the digits all well-developed, with strong, little curved claws, the thumb shorter than the other digits but armed with a large claw somewhat more curved than the others; palmar tubercles five, the three at bases of median digits large, ill-defined, that at base of thumb not so large as the others but better defined, its outer surface tending to become smooth and horny, the posterior pad largest, covering about one-third of entire palmar area; surface of pads (except as otherwise described) coarsely reticulate. Hind foot very large and broad, the digits united by a web extending to base of claws; second and third digits equal and longest, their claws heavy, scarcely concave on lower surface, considerably larger than those of other toes; first, fourth, and fifth toes successively shorter than second and third, their claws smaller

and more curved, that of fourth digit with a conspicuous, horny, laterally-compressed supplement fully as large as claw itself springing from ball of finger beneath claw; entire sole naked, the surface coarsely reticulate; three elongate, ill-defined pads at base of median digits, a larger and better-defined tubercle behind base of hallux; entire sole between hallucal tubercle and heel thickened and pad-like. Tail furred at extreme base, the scales of naked portion wider than long, 4–6-sided, about 100 in longitudinal series, forty in circumference, those on lower side somewhat larger and better defined than those on upper side. Fur consisting of dense soft under portion, the hairs of which are about 25 mm. in length, and an abundant growth of rather coarse stiff longer hairs (50 to 60 mm.) nearly concealing the underfur.

Colour.—General colour a peculiar clayey buff produced by the longer hairs, and very uniform throughout, the underparts a little less yellowish; underfur light smoke-grey at base, darkening to hair-brown or bister at tips, this colour rarely showing through at surface; muzzle, chin, and lower part of cheeks greyish but not forming any decided contrast with surrounding parts; feet washed with a drab brown.

Skull.—In general aspect the skull is low, robust and heavily-built, though not conspicuously ridged and furrowed, and not noticeably widened; the broadly expanded malar is a conspicuous feature in lateral view. Dorsal profile moderately and irregularly convex, usually with a flattened or slightly concave area between orbits and another just in front of lambdoid region; occiput squarely truncate or somewhat overhanging, the condyles barely or not visible when skull is viewed from above; ventral profile, owing to depth of rostrum and shallowness of brain-case not diverging conspicuously in general direction from dorsal profile except for the projection formed by the tooth-row and by the auditory bulla. Brain-case rather narrowly ovate in general outline, its breadth over roots of zygomata contained about $1\frac{1}{4}$ times in length; meatal tubes of auditory bullæ standing out conspicuously just in front of mastoid protuberances and rising to level of dorsal surface of brain-case; sagittal crest moderately developed in adults, highest posteriorly, dividing anteriorly into two low ridges curving forward and outward to rudimentary postorbital processes; lambdoid crest well developed, sloping backward; occiput low and broad, somewhat quadrate in outline when viewed from behind, scarcely exceeded in height by middle portion of brain-case, its median height slightly more than half its greatest width, its surface with no special features; paroccipital process short and robust, not extending to level of lower lip of foramen magnum; floor of brain-case with deep pit occupying entire area between bullæ, its edges well defined throughout, its posterior margin formed by lower lip of foramen magnum; auditory bulla flask-shaped, the meatal tube about as

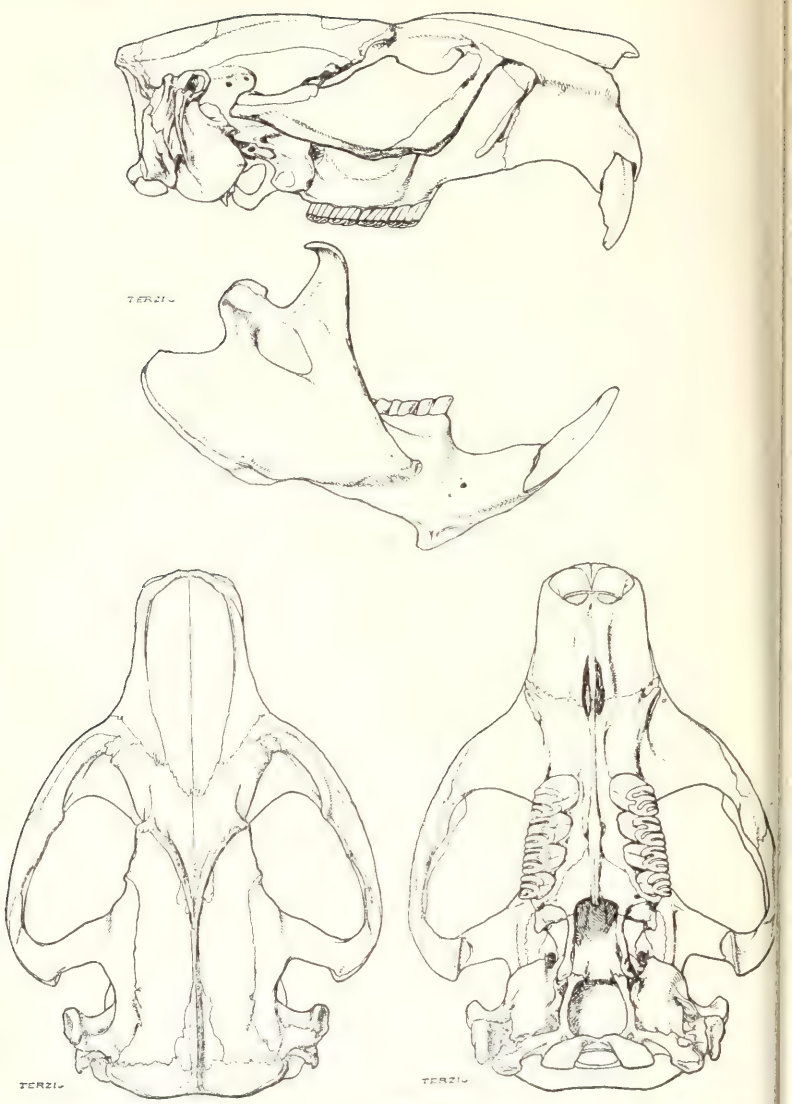


Fig. 197.
Castor fiber. $\times \frac{1}{3}$.

long as transverse diameter of inflated portion of bulla, conspicuously ridged postero-externally, the main axis of flask oblique but nearly upright, sloping outward at an angle of only about 30°; portion of bulla appearing on lower surface of skull about 1½ times as long as wide, evenly inflated, the width at middle about equal to that of transverse diameter of basioccipital pit measured inside the rim; bulla separated posteriorly and postero-externally from paroccipital and mastoid processes by a broad irregular groove. Interorbital region short and wide, imperfectly marked off from brain-case by the rudimentary post-orbital processes. Zygomata heavy, gradually spreading, the greatest zygomatic breadth about at glenoid level; malar large, greatly expanded at middle, its upper edge with projection marking posterior limit of orbit, its depth through this projection rather greater than diameter of orbit, its anterior extremity firmly ankylosed with lachrymal; anteorbital foramen minute, slit-like or rounded, vertical, hidden in lateral view by the oblique ridge which forms its outer margin and extends downward toward alveolus of first cheek-tooth. Rostrum heavy and deep, its least depth nearly equal to depth of brain-case at middle, but less than distance from anteorbital foramen to gnathion; region between incisors and lower rim of nares conspicuously thickened; nasals gradually narrowing from before backward, their greatest combined breadth usually much less than half length, their posterior border extending about to level of middle of orbit, and decidedly behind ends of nasals branches of premaxillaries; incisive foramina slit-like, parallel sided, situated somewhat nearer to incisor than to cheek-teeth, their greatest length about one-third that of diastema. Palate narrow, its width between anterior cheek-teeth about one-half that of alveolus, its width between posterior cheek-teeth about twice that of alveolus (the relative width of palate greater in immature individuals); posterior border slightly behind level of m^3, its median spine well developed; mesopterygoid space about two-thirds as long as palate, its width posteriorly nearly three-quarters its length, fully half its lateral border formed by the long, robust, distally thickened hamular. Mandible very robust, the ramus much thickened to accommodate the constantly growing roots of the cheek-teeth on outer side of large incisor-shaft, the symphysis extending backward in adults to level of posterior border of first cheek-tooth; articular process very short, the surface of the condyle scarcely extending beyond a line joining tip of high, abruptly recurved coronoid process with hinder extremity of evenly rounded-off angular process.

Teeth.—Upper incisor heavy, its course scarcely indicated on outer surface of rostrum, its root lying behind anteorbital foramen; shaft about as deep as wide, the anterior face slightly curved, a little longer than sub-equal outer and inner faces, the posterior border abruptly rounded; enamel dark yellowish brown in colour, essentially smooth but with very obscure longitudinal

wrinkles; lower incisor with root extending slightly beyond m_3, which is deflected outward to allow its passage; section of shaft much as in upper tooth but antero-posterior diameter relatively greater and inner border more flattened. Cheek-teeth large, their roots forming conspicuous capsule-like projections in orbit, and low but evident protuberances on lower portion of outer side of lower jaw, both upper and lower root capsules becoming less noticeable with advancing age; outline of crowns squarish, tending to be broader than long above, longer than broad in the mandibular teeth, the outer border of upper teeth and inner border of lower teeth straight, slightly crenulate, the opposite borders distinctly bilobed. The pattern of enamel folding is essentially the same in all the teeth: three narrow re-entrant folds on one side, a single wider fold on the other; in the maxillary teeth the three folds are on the outer side, while in the mandibular teeth they are on the inner side; inner fold in maxillary teeth nearly straight, extending obliquely forward to come in contact with extremity of first outer fold, or frequently in pm^4 to curve slightly behind it; outer fold in mandibular teeth curving backward between extremities of second and third inner folds, with both of which it is nearly or quite in contact. In the maxillary teeth the first outer fold extends obliquely forward half-way across crown, or in pm^4 occasionally about to inner border, the second outer fold curves noticeably backward and extends nearly to inner side of crown, and the third outer fold extends directly inward or somewhat obliquely backward, its length equal to or a little less than that of first fold, except when the latter assumes its lengthened form. In the mandibular teeth the first and third inner folds extend nearly across crown, while the second is often distinctly shorter, all three are somewhat wavy in outline, the first the least so.

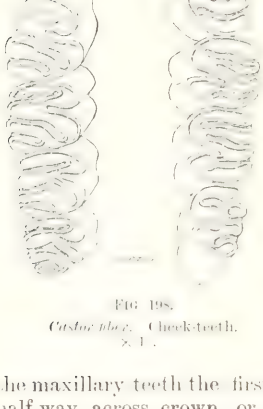


FIG. 198.
Castor fiber. Cheek-teeth. × 1.

Measurements.—Adult female from the Rhone, near Arles, France: head and body about 820; tail about 380; bare portion of tail (in dry specimen), 310 × 120; hind foot, 170; ear, 35. Immature male from the same region: head and body about 650; tail about 250; bare portion of tail (in dry specimen), 225 × 110; hind foot, 160. For cranial measurements see Table opposite

Specimens examined.—Six, from the following localities:
NORWAY: Froland, Kristiansand, 1.
ENGLAND: Norfolk, 1 (skull).

CRANIAL MEASUREMENTS OF *CASTOR FIBER*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Mastoid breadth.	Occipital depth.	Nasal.	Greatest breadth of both nasals together.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
Norway: Froland, Kristiansand	97.10.14.1	♂	129·2	95±	27·0	62·6	38·0	54·2	23·2	43·6	94·6	30·2	33·6	Premolars worn flat. Sagittal crest low.
England: Suffolk	85.8.4.4.1		142·0	106·4	30·4	69·0	42·8	61·4	29·0	48·0	109·0	33·6	36·8	Premolars worn flat. Sagittal crest high.
France: near Arles	5.3.9.1		143±	108·8	28·0	72·8	—	62·6	24·8	49·0	105·0	32·2	35·4	Premolars worn flat. Sagittal crest high.
Germany: Elbe River	6564 U.S.N.M.		125·6	84·4	25·6	61·0	36·0	50·8	23·2	38·2	89·0	29·8	32·6	Premolars not flat.
Austria-Hungary: Danube River	875. b.		149·4	110·0	29·0	72·8	43·4	64·0	26·0	51·0	113·0	33·8	37·0	Premolars worn flat. Sagittal crest high.

FRANCE: Rhone, near Arles, 2; near Avignon, Vaucluse, 1.
GERMANY: Elbe River, 1 (U.S.N.M.).
AUSTRIA-HUNGARY: Danube, 1 (skull).

Remarks.—The material examined does not indicate the existence of more than one form of beaver in Europe. *Castor fiber* is nearly related to the American beaver, *C. canadensis*. In the American animal the least depth of rostrum behind incisors usually equals or slightly exceeds the distance from gnathion to anteorbital foramen, and the nasals terminate posteriorly at lachrymal level, slightly behind nasal branches of premaxillaries.

♂, skeleton.	Froland, Kristiansand, Norway.	Dr. R. Collett (P).	97.10.14.1.
Skeleton.	Norfolk, England (from peat-bog).	W. J. Angove (C).	85. 8. 4. 1.
♂.	Arles, Bouches du Rhône, France. (*Dr. P. Siepi.*)	Lord Lilford (P).	94. 5. 30. 1.
♀.	Arles, Bouches du Rhône.	Dr. P. Siepi (C).	5. 3. 9. 1.
1.	Avignon, Vaucluse.	Purchased (Deyrolle).	85. 5. 26. 1.
Skull.	Danube, Austria-Hungary.	Purchased (Brandt).	875. b.

Order UNGULATA.

1801. *Ungulata* Bechstein, Gemeinn. Naturgesch. Deutschlands, I, 2nd ed., p. 182.

Geographical distribution.—Essentially throughout all of the larger land masses of the world, Australia excepted.

Characters.—Terrestrial, herbivorous or omnivorous, placental mammals with broad-crowned, tuberculated or ridged molars, digitigrade feet, and hoofed digits.

Remarks.—The exact limit of the order *Ungulata* is still a matter of controversy. The group is here considered as equivalent to the *Diplarthra*. Thus restricted it contains two main groups, the *Artiodactyla*, in which the main axis of the foot lies between the third and fourth digits, producing the well-known cloven hoof, and the *Perissodactyla*, in which the main axis of the foot passes through the middle of the third digit. All the European members of the order now existing in the wild state belong to the sub-order *Artiodactyla*. The genus *Equus*, representing the *Perissodactyla*, probably disappeared as a natural member of the fauna of western Europe during paleolithic times. The *Artiodactyla* are at present the most widely distributed and abundantly represented of the order. About eight families, eighty genera and six hundred species are currently recognized. Three families and nine genera are represented among the species now occurring in western Europe.

The *Ungulata* of Europe are so inadequately represented in the British and other Museums that it has been found impossible to treat the group in the same manner as the preceding orders. No general monographic study of any genus has been possible. The descriptions have consequently been reduced to diagnosis, and some of the recently named forms are entered at second hand.

ARTIFICIAL KEY TO THE EUROPEAN FAMILIES OF *ARTIODACTYLA*.

Upper incisors present; lower canine not incisor-like; horns absent (Pigs)..... *Suidæ*, p. 956.

Upper incisors absent; lower canine incisor-like; horns present, at least in males.

Horns, consisting of an outer sheath supported by a bony core growing from the frontal bone, present at all times in adult males and usually in females (Cattle, sheep, goats, &c.)..... *Bovidæ*, p. 986.

Horns (antlers), consisting of a solid bony outgrowth from the frontal bone, periodically shed and renewed, often absent in females (Deer)..... *Cervidæ*, p. 962.

Family SUIDÆ.

1821. *Suidæ* Gray, London Med. Repos., xv, p. 306, April 1, 1821.

Geographical distribution.—Warmer and temperate portions of the Old World from Japan and the Philippines to Ireland (now extinct in the British Islands), south throughout Africa (including Madagascar) and in the Malay region to New Guinea.

Characters.—Snout elongated, the abruptly truncate muzzle terminating in a vertically flattened, expanded pad supported by a well developed free ossicle (not shown in figs. 199 and 200); incisors rooted, the upper teeth normally present though sometimes lost in old age; upper canine curving outward and upward at side of muzzle; molars bunodont; stomach essentially simple; feet with four well-developed toes; no horns or antlers.

Remarks.—The family *Suidæ* contains at least six well-defined living genera. Only one of these, the typical *Sus*, occurs in Europe.

Genus SUS Linnæus.

1758. *Sus* Linnæus, Syst. Nat., I, 10th ed., p. 49.
1766. *Aper* Pallas, Miscellanea Zoologica, p. 16 (Substitute for *Sus*).
1815. *Aper* Rafinesque, Analyse de la Nature, p. 56 (Substitute for *Sus*).
1857. *Sus* Blasius, Säugethiere Deutschlands, p. 508.
1868. *Scrofa* Gray, Proc. Zool. Soc., London, p. 38 (Domestic Pig).

Type species. *Sus scrofa* Linnæus (by tautonymy).

Geographical distribution.—Same as that of the family *Suidæ*, except that in Africa it is confined to the Mediterranean region.

Characters. Dental formula: $i\frac{3}{3}, c\frac{1}{1}, pm\frac{4}{4}, m\frac{3}{3} = 44$; incisors and premolars tending to remain functional throughout life, though the small i^3, pm^1 and pm_1 are not infrequently lost; bunodont structure of molars showing no special modification; canines small in females, moderately large and conspicuously trenchant in males; skull elongate, high and narrow, typically suine and without conspicuous modifications.

Remarks. The genus *Sus* as now understood contains about thirty recognized living species, mostly of the Indo-Malayan region. Two appear to be readily distinguished among the members of the group occurring in western Europe.

KEY TO THE EUROPEAN SPECIES OF *SUS*.

Upper length of skull in adult males usually more than 350 mm.; m^3 with third transverse ridge well developed (Distribution general) ..... *S. scrofa*, p. 957.
Upper length of skull in adult males usually less than 300 mm.; m^3 with third transverse ridge obsolete (Sardinia) ..... *S. meridionalis*, p. 960.

SUS SCROFA Linnæus.

1758. [*Sus*] *scrofa* Linnæus, Syst. Nat. I, 10th ed., p. 49.
1785. [*Sus*] *setosus* Boddaert, Elenchus Animalium, I, p. 157 (Substitute for *scrofa*).
1785. [*Sus setosus*] *a aper* Boddaert, Elenchus Animalium, I, p. 157 (Special name for the wild boar).
1811. *Sus europæus* Pallas, Zoogr. Rosso-Asiat., I, p. 265 (Substitute for *scrofa*).
1857. *Sus scrofa* Blasius, Säugethiere Deutschlands, p. 510.
1882. [*Sus scrofa*] var. *celtica* Strobel, Atti Soc. Ital. Sci. Nat., Milano, XXV, p. 79, June, 1882 (Renaming of true *scrofa*).
1910. *Sus scrofa* Trouessart, Faune, Mamm. d'Europe, p. 225.

Type locality.—Germany.

Geographical distribution.—Southern and central Europe,

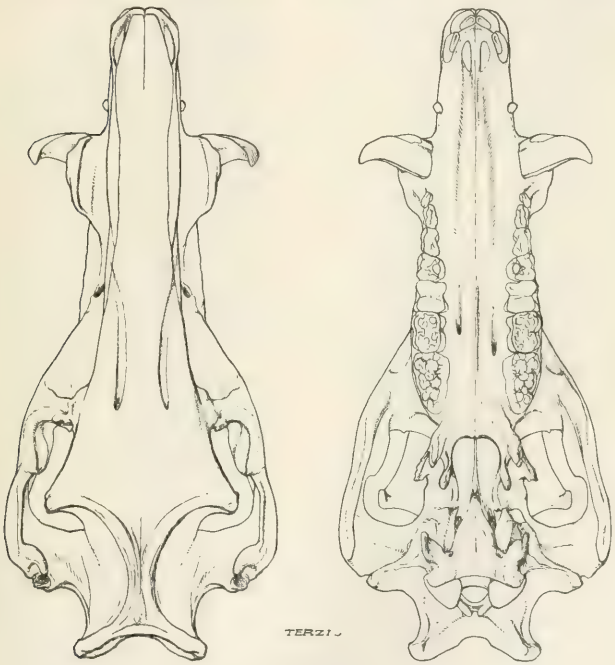


FIG. 199.
Sus scrofa. × ¼.

formerly west to Ireland and north to southern Norway and Sweden; now restricted to that portion of the Continent lying

south of the Baltic, and occurring in forested regions only; eastern limit of range unknown.

Diagnosis.—Size rather large, the length of head and body about 1·5 m. in full-grown males, somewhat less in females, upper length of skull in adult males about 350 mm., upper tooth-row including canine 143–152 mm.; posterior upper molar large, its third transverse ridge evident; general colour of adults brown, in different individuals tending to become blackish, greyish or reddish, the nature of these variations not understood; face, cheeks and throat grizzled by sprinkling of whitish

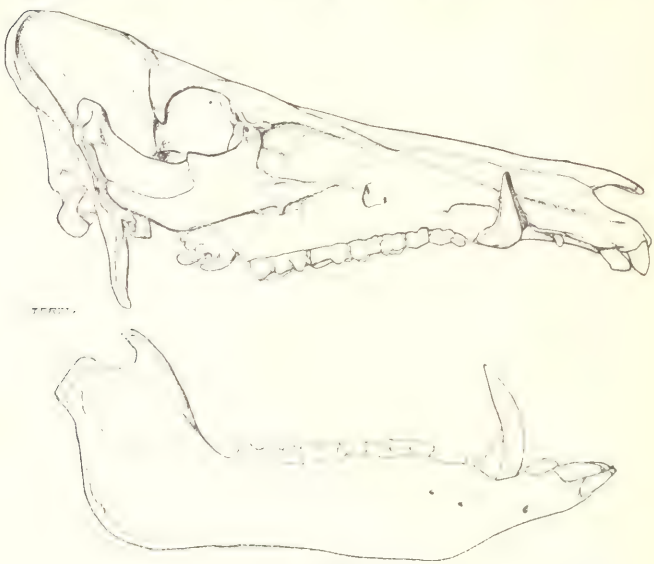


FIG. 209.
Sus scrofa. ×

hairs, but these not tending to produce definite markings; new-born young brown with conspicuous blackish stripes; bristles along median line of neck lengthened but not forming a conspicuous crest; underfur everywhere dense and woolly.

Measurements.—Adult male from Province of Burgos, Spain: head and body about 1300; tail, 170; longest hairs at tip of tail, 200; hind foot (with hoof), 250; length of hind hoof along inner border, 50; length of fore hoof along inner border, 70; ear from crown, 115; width of ear, 90; length of hairs at upper edge of ear, 30. For cranial measurements see Table, p. 961.

Specimens examined.—Sixteen, from the following localities:—
FRANCE: No exact locality, 1.
GERMANY: Harz Mountains, 1 skull (U.S.N.M.); Waldleinigen, Odenwald, N. Baden, 1; Würtemberg, 2 (skulls); no exact locality, 2.

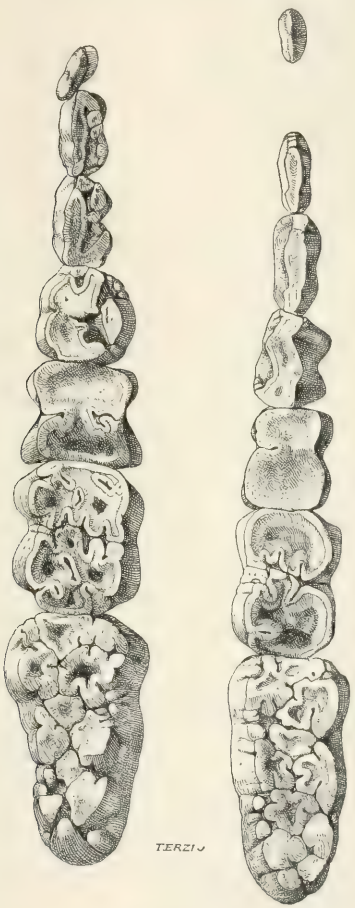


FIG. 201.
Sus scrofa. Cheek teeth, nat. size.

ITALY: San Rossore, Tuscany, 3 (Turin).
SPAIN: Pinares de Quintanar, Burgos, 3 (B.M. and U.S.N.M.); Almonte, Seville, 1; Coto Doñana, Huelva, 2.

Remarks.—Though it seems probable that more than one geographical race of wild boar may occur in western Europe the material examined is entirely inadequate to the formation of any definite opinion on the subject.

[Since this account of *Sus scrofa* was in type three new forms have been recognized by Thomas:—

Sus attila Thomas, Abstr. Proc. Zool. Soc. London, No. 105, p. 1, March 12, 1912. Type locality, Koloszvar, Austria-Hungary. Distribution, Hungary and Russia. Much larger than *Sus scrofa* (upper length of skull, 452 mm.; height of skull at occiput, mandible included, 271 mm.). Based on an adult male, No. 12. 1. 23. 1, presented by Miss Sarolta von Wertheimstein.

Sus scrofa castilianus Thomas, Abstr. Proc. Zool. Soc. London, No. 105, p. 1, March 12, 1912. Type locality, Province of Burgos, Spain. Distribution, northern Spain. Smaller than true *Scrofa* (upper length of skull, 353 mm.; height at occiput, 198).

Sus scrofa baticus Thomas, Abstr. Proc. Zool. Soc. London, No. 105, p. 2, March 12, 1912. Type locality, Coto Doñana, Huelva, Spain. Distribution, southern Spain. Smaller than *castilianus* (upper length of skull, 324 mm.; height at occiput, 208).]

1 (juv.).	France.	Purchased (Lefebvre).	43. 12. 29. 12.
♂.	Waldleinigen, Odenwald, N. Baden, Germany.	H.R.H. Grand Duke Louis of Hesse (C & P).	92. 8. 3. 1.
♂ skull.	Wurtemberg.	Dr. A. Günther (C).	59. 9. 6. 100.
♂ skeleton.	Germany.	Zoological Society's Museum.	713. M.
♂ skull.	Germany.	Purchased.	62. 3. 20. 6.
♂.	Province of Burgos. (*Recr. S. Gonzalez.*)	Hon. N. C. Rothschild (P). (Type of *S. s. castilianus* Thomas.)	11. 10. 5. 3.
2 ♀.	Quintanar de la Sierra, Burgos.	S. & N. Gonzalez (C).	8. 7. 7. 32-33.
♀.	Almonte, Seville, Spain. (*A. Ruiz.*)	Lord Lilford (P).	95. 9. 4. 16.
♂.	Coto Doñana, Huelva.	A. Chapman (C & P). (Type of *S. s. baticus* Thomas.)	8. 3. 8. 12.
♂ skull.	Coto Doñana.	A. Chapman (C & P).	8. 3. 8. 13.

SUS MERIDIONALIS Major.

1881. *Sus scrofa meridionalis* Major, Atti Soc. Tosc. Sci. Nat., Pisa, Proc. Verb., III, p. 119 (Sardinia; the wild pig). Fully described in Vol. VI, fasc. 2, pp. 346-362, 1883.

1882. ? *Sus scrofa* var. *sardous* Strobel, Atti Soc. Ital. Sci. Nat., Milano, XXV, p. 221 (Sardinia; the domestic pig).

1910. *Sus scrofa sardous* Trouessart, Fauna Mamm. d'Europe, p. 226 (the wild pig).

Type locality.—Sardinia.

Geographical distribution.—Sardinia.

CRANIAL MEASUREMENTS OF EUROPEAN SPECIES OF *SUS*.

Locality.	Number.	Sex.	Upper length.	Condylobasal length.	Zygomatic breadth.	Least interorbital breadth.	Nasal.	Greatest combined breadth of nasals.	Occipital depth (median).	Palatal depth at m^3.	Mandible.	Maxillary tooth-row including canine.	Maxillary tooth-row excluding canine.	Mandibular tooth-row including canine.	Mandibular tooth-row excluding canine.	Third upper molar.	Third lower molar.	Observations.
Sus scrofa.																		
Germany: Wurtemberg	59. 9. 6. 100	♂	356	328	135·4	72·6	194	36·6	110·0	78·0	275	147	—	149	—	38·0×20·4	35·0×19·0	m^3 in place, not worn
,,	62. 3. 20. 6	♂	332	319	119·0	70·0	186	33·4	102·0	79·0	270	152	—	160	—	38·0×19·0	38·4×16·0	,, not in place.
Harz Mts.	1964 Merriam	♂	370±	342	139·0	76·6	190±	30·0	122·0	83·6	292	165	135·0	180	154	39·6×21·0	47·0×18·2	,, ,, ,,
Italy: San Rossore	Turin 4820	♂	353	334	148·0	85·0	196	39·0	122·0	84·0	295	149	116·0	163	—	33·0×20·0	36·6×16·0	,, slightly worn.
,, ,,	Turin 4821	♂	350	332	152·0	85·0	191	32·0	122·0	85·0	290	143	116·0	158	—	34·0×18·0	32·8×15·0	,, ,, ,,
Spain: Prov. Burgos	11. 10. 5. 3*	♂	353	336	137·0	79·0	191	30·4	114·0	84·0	295	157	126·0	169	141·0	41·6×22·0	42·0×18·0	,, moderately worn
,, ,,	8. 7. 7. 33	♀	333	306	131·0	73·0	166	27·4	102·0	80·4	269	138	118·0	145	109·0	37·0×21·4	36·0×16·4	,, much worn.
Prov. Huelva	8. 3. 8. 12†	♂	324	305±	142·0	73·2	177	32·8	—	94·6	268	145	119·0	153	111·0	35·0×22·0	35·0×17·6	,, moderately worn
,, ,,	8. 3. 8. 13	♀	305	285	127·0	64·6	158	27·2	100·0	71·6	250	125	103·0	136	95·0	27·0×16·0	29·0×13·2	,, much worn.
Sus attila.																		
Austria-Hungary	12.1.23.1‡	♂	452	405	176·0	102·0	250	52·0	159·0	—	363	177	135·0	195	164·0	40·0×24·0	42·0×19·5	,, slightly worn.
Sus meridionalis.																		
Sardinia: Sassari	Genoa 3214	♂	277	260±	120·0	65·0	139	26·0	95·4	75·4	227	114	94·4	125	88·6	27·0×16·0	29·2×13·4	,, moderately worn
,,	Genoa	♂	302	—	124·0	66·4	158	31·4	—	71·8	237	128	101·0	135	94·0	29·0×17·6	30·4×13·0	,, slightly worn.
Sarrabus	,,	♂	290	266	119·0	66·0	155	25·0	96·4	75·0	228	126	101·0	135	92·0	28·0×15·6	27·6×13·0	,, in place, not worn
near Siliqua	Genoa M. 188	♂	309	270	121·0	67·0	156	28·0	105·0	74·6	238	123	99·0	137	92·4	28·0×15·0	29·0×13·4	,, ,, ,,
Monti di Capoterra	Genoa M. 189	♀	265	242	103·0	53·0	128	25·4	80·4	67·0	197	110	94·0	115	90·0	25·0×15·0	27·0×13·0	,, ,, ,,

* Type of *castilianus* Thomas. † Type of *beticus* Thomas. ‡ Type.

Diagnosis.—Like *Sus scrofa* but not attaining so great size, the upper length of skull in adult male about 300 mm., upper tooth-row including canine 114 to 128 mm.; posterior molar both above and below with third transverse ridge much reduced; colour in both adult and young essentially as in *Sus scrofa*.

Measurements.—For cranial measurements see Table, p. 961.

Specimens examined.—Five skulls (Genoa).

Remarks.—The wild boar of Sardinia appears to be a well-defined local form.

Family CERVIDÆ.

1820. *Cervidæ* Gray, London Med. Repos., xv, p. 307, April 1, 1821.

Geographical distribution.—Essentially the entire mainland of North and South America; in the Old World from the Arctic region south to extreme northwestern Africa, the Malay Archipelago and the Philippine Islands.

Characters.—Artiodactyles with frontal appendages usually occurring in males and sometimes in females, always, when present, in the form of solid, periodically shed and renewed antlers growing from permanent bases or pedicles on the frontal bones; molars usually (always in European members of the family) brachyodont; lateral digits of both fore and hind feet usually present.

Remarks.—About sixteen genera of living deer are known, a number which will probably be increased by more detailed study. Three of these, *Cervus*, *Alces* and *Rangifer*, are common to the northern portion of both Eastern and Western Hemispheres, four or five are peculiar to America, and the rest are confined to the Old World. Five occur in Europe.

KEY TO THE EUROPEAN GENERA OF *CERVIDÆ*.

Vomer high, dividing posterior nares into two chambers; no marked contrast in size between anterior premolar and m^2; width of upper molars about one-fourth that of palate; antlers normally present in both sexes, the base of pedicle situated conspicuously behind level of orbital cavity; lateral hoofs functional; main hoofs very short and broad, the outline of the entire sole subcircular; muzzle entirely hairy; antlers beginning to develop within a few weeks of birth (Reindeer)..... *Rangifer*, p. 979.

Vomer low, not dividing posterior nares into two chambers; a marked contrast in size between anterior premolar and m^2; width of upper molars about one-third that of palate; antlers normally present in males only, the base of pedicle extending over posterior portion of orbital cavity; lateral hoofs not functional; main hoofs narrow, the outline of the entire sole noticeably longer than wide; muzzle not entirely hairy; antlers not beginning to develop until about a year after birth.

Rostrum lengthened and nasal shortened, so that distance from front of nasal to front of premaxillary is about equal to that from back of nasal to back of occiput; antlers conspicuously palmate, the shaft nearly horizontal; muzzle hairy except for a small bare spot between nostrils; young not spotted (Elk)..... *Alces*, p. 976.

Rostrum and nasal normal, the distance from front of nasal to front of premaxillary much less than half that from back of nasal to back of occiput; antlers terete or slightly palmate, the shaft ascending; muzzle naked; young spotted with white.

Maxillary canines present in both sexes; antlers terete, spreading, the brow tine, bez tine and trez tine usually present in fully developed individuals (Red Deer)..... *Cervus*, p. 963.

Maxillary canines absent, antlers either not terete or not spreading, the complement of tines not entire.

Auditory bullæ evenly inflated, their surface without conspicuous ridges; antlers spreading, without bez tine, the distal portion narrowly palmate; tail well developed (Fallow deer)... *Dama*, p. 970.

Auditory bullæ collapsed, their surface conspicuously ridged; antlers erect, terete, without brow tine; tail reduced to an inconspicuous papilla (Roe Deer)..... *Capreolus*, p. 973.

Genus **CERVUS** Linnæus.

1758. *Cervus* Linnæus, Syst. Nat., I, 10th ed., p. 66.
1827. *Elaphus* Hamilton Smith, Griffith's Cuvier, Animal Kingdom, v, p. 307 (Substitute for *Cervus*).
1857. *Cervus* Blasius, Säugethiere Deutschlands, p. 438 (part).
1899. *Eucervus* Acloque, Faune de France, Mamm., p. 71 (not of Gray, 1866). Substitute for *Cervus*.

Type species.—*Cervus elaphus* Linnæus (by tautonymy).

Geographical distribution.—North temperate region of both Hemispheres; in the Old World west to the Atlantic coast of Norway, the British Islands and north-western Africa.

Characters.—Plesiometacarpalian deer of large size with narrow, elongate hoofs; maxillary canines present in both sexes; lower incisors (fig. 203) distinctly though not extremely differentiated in size and form; lachrymal vacuity widely open, the pit well developed, moderate; vomer low posteriorly, showing no tendency to divide the posterior nares into two chambers; antlers large, spreading, terete, not beginning to grow until about a year after birth, when fully developed with five or more tines including the brow tine; base of pedicle extending conspicuously over posterior portion of orbital cavity; tail well developed, moderate; muzzle naked; young spotted with white, their colour very different from that of adults.

Remarks.—The genus *Cervus* as thus defined contains the Red Deer group and its immediate allies. The exact limits of the genus are not definitely known; but there can be no doubt

that the name *Cervus* is currently applied to several groups which should be recognized as distinct.

It is not possible to attempt any revision of the European members of this genus, since the requisite material, if it exists, cannot now be brought together in one place. So far as can be judged from the few specimens seen and from the descriptions recently published, there is a distinct small form confined to Sardinia, and a wide ranging, rather plastic continental animal occurring in the forested regions, where not exterminated, from Spain and Ireland eastward, and from Scotland and west-central Norway to the Mediterranean coast. Apparently the Spanish, British and Norwegian forms are smaller than those inhabiting central Europe, while the largest specimens occur in eastern Hungary. Although there is no probability that this course is final I am treating all the European forms as geographical races of *Cervus elaphus*.

CERVUS ELAPHUS Linnæus.

(Synonymy under subspecies.)

Geographical distribution. Forested regions (where not exterminated) from Spain and Ireland eastward, and from Sardinia

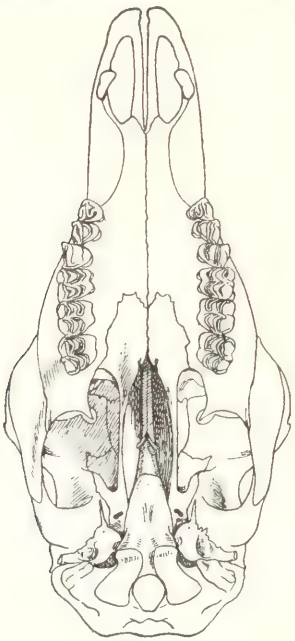


FIG. 202.
Cervus elaphus. × ⅓.

and the Mediterranean coast to northern Scotland and central Sweden; an isolated race on the coast of central Norway; absent from the peninsula of Italy; eastern limit of range not known.

Diagnosis.—Height at shoulder about 1370 mm. or less; upper length of skull in adult male usually about 330 to 370 mm.; tail rather long, pointed; ear more than half as long as head; general colour reddish brown in summer, greyish brown in winter,

FIG. 203.
Cervus elaphus. Incisiform teeth. Nat. size.

the underparts always somewhat paler (drab), but never strongly contrasted; a dark dorsal line sometimes present; no conspicuous whitish markings except occasionally the speculum, which may however be indistinct; antlers terete throughout except for the flattening which often occurs in region of "cup" in old individuals; in fully developed antlers there are normally present a brow tine, bez tine and more than 5 points.

CERVUS ELAPHUS GERMANICUS Desmarest.

1822. *Cervus elaphus germanicus* Desmarest, Mammalogie, II, p. 434 (Germany).
1822. ? *Cervus elaphus albus* Desmarest, Mammalogie, II, p. 435 (*nomen nudum*).
1845. *Cervus elaphus albifrons* Reichenbach, Vollständigste Naturgesch. des In- und Auslands, Säugeth., III, pl. III *bis*, fig. 26 (no exact locality; see p. 18).
1857. *Cervus elaphus* Blasius, Säugethiere Deutschlands, p. 439.
1874. *Cervus elaphus, varius* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LXIX, pt. I, p. 574 (Germany).
1874. *Cervus elaphus, albus* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LXIX, pt. I, p. 575 (Germany).
1898. ? *Cervus elaphus maral* Lydekker, Deer of All Lands, p. 79 (part; specimens from the Galician Carpathians, Hungary).
1903. *Cervus vulgaris* Botezat, Morphol. Jahrb., XXXII, p. 115, November 17, 1903 (Renaming of *elaphus*).

1903. ? *Cervus vulgaris campestris* Botezat, Morphol. Jahrb., XXXII, p. 154, November 17, 1903 (Lowlands and beech forests on lower slopes of Carpathian Mountains, Bukowina, Austria-Hungary). Not *Cervus campestris* F. Cuvier, 1817.

1903. ? *Cervus vulgaris montanus* Botezat, Morphol. Jahrb., XXXII, p. 155, November 17, 1903 (Carpathian Mountains, Bukowina, Austria-Hungary).

1906. *Cervus elaphus germanicus* Lönnberg, Arkiv för Zoologi, III, No. 9, p. 14, January 22, 1906.

1907. ? *Cervus balticus* Matschie, Das Waidwerk in Wort und Bild, XVI, p. 186, March 15, 1907 (Forest near Liebemühl, Ostpreussen, Germany).

1907. ? *Cervus albicus* Matschie, Das Waidwerk in Wort und Bild, XVI, p. 186, March 15, 1907 (Muskau, Oberlausitz, Silesia, Germany).

1907. ? *Cervus rhenanus* Matschie, Das Waidwerk in Wort und Bild, XVI, p. 186, March 15, 1907 (Viernheim, Hessen-Darmstadt, Germany).

1907. ? *Cervus bajovaricus* Matschie, Das Waidwerk in Wort und Bild, XVI, p. 186, March 15, 1907 (Rohner, Konigssee, Oberbayern, Germany).

1910. *Cervus elaphus germanicus* Trouessart, Faune Mamm. d'Europe, p. 228.

Type locality. Germany.

Geographical distribution.—Continental Europe, limits of range not known; animals of this general type occur from the Mediterranean region to the Baltic and from western France to eastern Hungary, though they probably represent more than one geographical race.

Diagnosis. Size large, as in *C. elaphus elaphus*; caudal disk conspicuously lighter than flanks and usually with a definite black or blackish border.

Measurements.—For cranial measurements see Table, p. 982.

Specimens examined.—Nine, from the following localities:—
FRANCE: No exact locality, 2.
GERMANY: Göhrde, Hanover, 1; south Germany, 1; no exact locality, 1.
AUSTRIA-HUNGARY: Bohemia, 2; Carpathians, 1.
ITALY: Campo Carnico, Cadore, 1 (Turin).

Remarks.—The German Red Deer has been divided by Matschie into the following species, based primarily on peculiarities of the antlers. I am unable to express any opinion as to the validity of these forms.

Cervus balticus.—Antlers with beam evenly and gradually concave on inner border; points of all tines directed inward. Type locality: Liebemühl, Ostpreussen. Additional specimens mentioned from Auer, Ostpreussen, Cladow-West, Ostpreussen (near the Baltic divide), Hartingswalde, Ostpreussen, Kommusin, Ostpreussen, Ramuck, Ostpreussen, Schwalgendorf, Ostpreussen, and Klein-Ottlau, Westpreussen.

Cervus albicus.—Antlers with beam bent abruptly inward at level of trez tine; points of inner tines directed inward, those of outer prongs directed upward. Type locality: Muskau, Ober-

lausitz, Silesia. Range: middle Germany south of the Baltic divide, west to the Weser divide, and south to the Main divide.

Cervus rhenanus.—Antlers with beam bent abruptly inward at level of trez tine; points of all tines directed upward. Type locality: Viernheim, Hessen-Darmstadt. Range: western Germany from the Harz Mountains to the Danube basin.

Cervus bajoraricus.—Antlers as in *C. rhenanus*, but with inner tines directed inward and backward. Type locality: Rohmer, Königssee, Oberbayern. Distribution: Oberbayern.

One or more forms of Red Deer probably distinct from *C. elaphus germanicus* occur in eastern Hungary. They have been referred to *C. elaphus maral* (type locality, "the Persian Mountains") by Lydekker, and have been described as new under the names *campestris* and *montanus* by Bozetat.

♀ & yg. st.	France.	Purchased (Lefebvre).	43. 12. 29. 5 & 14.
♂ frontlet (hornless).	Göhrde, Hanover. (*H.M. Emperor William I.*)	J. E. Harting (P).	88. 6. 12. 1.
♀ skull.	S. Germany.	Dr. A. Günther (C).	59. 9. 6. 103.
♂ antlers.	Germany.		689. p.
2 ♂ antlers.	Bohemia.	Col. J. Evans (P).	89. 11. 20. 1–2.
♂ antlers.	Carpathians.	H.H. Prince Heinrich von Liechtenstein (P).	96. 10. 10. 1.

CERVUS ELAPHUS ELAPHUS Linnæus.

1758. [*Cervus*] *elaphus* Linnæus, Syst. Nat., I, 10th ed., p. 67.

1906. *Cervus elaphus* Lönnberg, Arkiv för Zoologi, III, No. 9, p. 9, January 22, 1906.

Type locality.—Southern Sweden.

Geographical distribution.—"The [range] .... extended in bygone days probably over the greater part of Götaland. At present the red deer is in Sweden confined to southern Skania, and there chiefly found on a few large estates, Häckeberga, Öfvedskloster, Börringe, Söfdeborg, Snogeholm, Skabersjö, etc. The number is quite small, perhaps not more than about 100 in all" (Lönnberg).

Diagnosis.—Size large; caudal disk not conspicuously lighter than flanks and never with a definite black border.

Remarks.—I have not seen this animal. From Lönnberg's account it appears to be sufficiently different from the stag of central Europe to merit recognition by name.

CERVUS ELAPHUS ATLANTICUS Lönnberg.

1906. *Cervus elaphus atlanticus* Lönnberg, Arkiv för Zoologi, III, No. 9, p. 9, January 22, 1906.

1910. *Cervus elaphus atlanticus* Trouessart, Faune Mamm. d'Europe, p. 228.

Type locality.—Hitteren Island, Trondhjem, Norway.

Geographical distribution.—West coast of Norway from Stavanger Fjord north to about latitude 65°.

Diagnosis.—Size smaller and colour paler than in true *Cervus elaphus*; caudal disk with distinct dark border.

Measurements.—For cranial measurements see Table, p. 982.

Specimens examined.—Two, one from Fredö, Norway, the other from Sloppen, Nordfjord, Norway (both U.S.N.M.).

Remarks.—Though sharply differentiated from the Swedish and central European forms, the Norwegian red deer closely resembles that of Scotland.*

Cervus elaphus scoticus Lönnberg.

1906. *Cervus elaphus scoticus* Lönnberg, Arkiv för Zoologie, III, No. 9, p. 11, January 22, 1906.

1910. *Cervus elaphus scoticus* Trouessart, Faune Mamm. d'Europe, p. 228.

Type locality. Glenquoich Forest, Inverness-shire, Scotland.

Geographical distribution. Great Britain; limits of range not known.

Characters.—Like *Cervus elaphus atlanticus* but colour darker and less grey.

Measurements. For cranial measurements see Table, p. 982.

Specimens examined.—Eighteen, from the following localities: Balmacaan, Inverness, Scotland, 2; Island of Jura, Scotland, 5; Fort William, Lochaber, Scotland, 1; Loch Sunart, Argyllshire, 1; Jura, Ardgour, Argyllshire, 2; Northumberland, 1; Woburn Abbey, Bedfordshire, 1; Exmoor, Devon, 1; England, no exact locality, 4.

Remarks.—The status of the British form of Red Deer is not well understood. The cranial characters mentioned by Lönnberg, as distinguishing the animal from *atlanticus*, are inconstant, but there appears to be an appreciable difference in colour between the two races.

♂, ♀.	Balmacaan, Inverness, Scotland.	Bradley Martin (P).	9. 1. 15. 1–2.
2 ♂ antlers.	Jura, Ardgour, Argyllshire.	F. Hamilton-Leigh (P).	11. 2. 21. 1–2
♂ skull without antlers.	Loch Sunart, Argyllshire.	Gen. Hamilton (P).	86. 6. 10. 1.
♀.	Fort William.	W. Jones (P).	8. 2. 10. 1.
3 skulls and 2 pairs of antlers.	Island of Jura.	Henry Evans (P).	96. 12. 21. 1–5.
♂ stuffed.	Alnwick Chase, Northumberland.	Duke of Northumberland (P).	63. 11. 16. 5.
♂ stuffed.	Woburn, Bedfordshire.	Duke of Bedford (P).	97. 4. 3. 3.

* For discussion of the meaning of this resemblance see Stejneger, Smithsonian Miscellaneous Collections, XLVIII, pp. 462–469, May 4, 1907, and Bergens Museums Aarbog, XIV, 1908.

♀ skull.	Exmoor, Devon.	R. A. Sanders (P).	6. 2. 26. 1.
♂ antlers.	England.		689. b.
♂ antlers.	England.	Purchased (Lead-beater).	46. 11. 20. 17.
♂ skull.	England.	Purchased (Baker).	47. 12. 11. 16.
♂ antlers.	(From a peat-bog.)	Jabez Allies (P).	49. 3. 5. 1.

CERVUS ELAPHUS HISPANICUS Hilzheimer.

1909. *C[ervus] elaphus hispanicus* Hilzheimer, Archiv für Rassen- und Gesellschafts-Biologie, 1909, p. 313. (South-western Spain?) Type in Stuttgart Museum.

1911. ? *Cervus elaphus bolivari* Cabrera, Bol. Real Soc. Españ. Hist. Nat. XI, p. 559, December, 1911 (El Pardo, Madrid, Spain). Type in Madrid Museum.

Type locality.—Spain, exact locality not known.*

Geographical distribution.—Iberian Peninsula, limits of range unknown.

Diagnosis.—Size apparently less than in *Cervus elaphus scoticus;* colour decidedly more greyish; skull narrower, particularly in interorbital and palatal regions.

Measurements.—For cranial measurements see Table, p. 982.

Remarks.—The Red Deer of Spain are divided by Cabrera into a smaller southern race (*hispanicus*) and a larger central and northern race (*bolivari*). At present the evidence seems inconclusive, though the cranial measurements (p. 982) tend to indicate the presence of two forms.

Specimens examined.—Four, from Coto Doñana, Huelva, Spain, and two from Pinares de Quintanar, Burgos, Spain (U.S.N.M.).

♂ ♀.	Coto Doñana, Huelva, Spain. (*A. Ruiz*).	Lord Lilford (P).	95. 9. 4. 14–15.
♂.	Coto Doñana.	A. Chapman (C & P).	8. 3. 8. 14.
♂ skull.	Coto Doñana.	A. Chapman (C & P).	8. 3. 8. 15.

CERVUS ELAPHUS CORSICANUS Erxleben.

1777. [*Cervus*] *corsicanus* Erxleben, Syst. Regni Anim., I, p. 304 (Corsica).

1822. *C[ervus] mediterraneus* Blainville, Journ. de Phys. Chem. Hist. Nat., XCIV, p. 262 (Corsica).

1855. [*Cervus elaphus*] *β minor* Wagner, Schreber's Säugth., Suppl., V, p. 354 (substitute for *corsicanus* and *mediterraneus*).

1910. *Cervus elaphus corsicanus* Trouessart, Faune Mamm. d'Europe, p. 229.

Type locality.—Corsica.

Geographical distribution.—Corsica† and Sardinia.

Diagnosis.—Size about as in *Cervus elaphus hispanicus* (height

* Dr. Hilzheimer informs me that the only clue to the history of the type is the fact that a pair of roebuck antlers in the Stuttgart collection was taken by the same collector in Estremadura.

† Polybius (XII, cap. III) states that the stag is not native to Corsica. (The Histories of Polybius translated by Evelyn S. Shuckburgh, II, p. 80).

at shoulder of mounted male in Turin Museum 800 mm.), but general colour darker than in any of the small continental forms.

Measurements. For cranial measurements see Table, p. 984.

Specimens examined.—Four, all from Corsica (Turin).

Genus **DAMA** Hamilton Smith.

1827. *Dama* Hamilton Smith, Griffith's Cuvier, Anim. Kingd., v, p. 306.

1844. *Platyceros* Wagner, Schreber's Säugth., Suppl., iv, p. 347.

1855. *Dactyloceros* Wagner, Schreber's Säugth., Suppl. v, p. 352 (Substitute for *Dama* and *Platyceros*).

1857. *Cervus* Blasius, Säugethiere Deutschlands, p. 39 (part).

1893. *Machlis* Zittel, Handb. Palaeont. iv, p. 402 (published as a synonym of *Dama* with Kaup as authority).

1898. *Palmatus* Lydekker, Deer of all Lands, p. 125. Wrongly attributed to Giebel, Säugethiere, p. 351 (a group name used in the plural: "*Palmati* mit schaufelförmigem Gewieh").

Type species.—*Cervus dama* Linnæus.

Geographical distribution.—Mediterranean region of southern Europe and western Asia; occurs in a condition of semi-domestication as far north as the British Islands and southern Scandinavia.

Characters.—Like *Cervus* but with skull shorter and relatively much broader, orbits larger, maxillary canines absent, cheek-teeth, particularly m^2, more brachydont, lower incisors (fig. 205) excessively differentiated in both size and form; antlers with brow tine and trez tine present, and a distinct though narrow palmation in region of surroyals.*

Remarks.—The Fallow Deer form a sharply defined group generically distinct from *Cervus*. Two species are known, one of which occurs in Europe.

DAMA DAMA Linnæus.

1758. [*Cervus*] *dama* Linnæus, Syst. Nat., i, 10th ed., p. 67.

1798. *Cervus platyceros* Cuvier, Tabl. Élém. de l'Hist. Nat. des Anim., p. 160 (Renaming of *dama*).

1816. *L* (sic) [*ervus*] *mauricus* F. Cuvier, Bull. des Sci. Soc. Philomath., 1816, p. 72 (locality not known).

* The extinct genus *Alce* Blumenbach (Handb. d. Naturgesch., 6th ed., p. 697, 1799, type *Alce giganteus* Blumenbach from the peat bogs of Ireland = "*Cervus megaceros*" Auct. or "*Megaceros hibernicus*" Auct.), though usually regarded as related to *Dama*, or even as identical with it (see Lydekker, Deer of all Lands, pp. 126–127, 1898, for statement of this extremely radical view), differs widely from all known genera of recent deer in the combination of plesiometacarpalian foot, high vomer nearly dividing posterior nares into two cavities, absence of maxillary canines and excessively reduced lachrymal vacuity (see Lönnberg, Arkiv för Zoologi, iii, No. 14, August, 1906).

1829. [*Cervus dama*] β. *leucæthiops* Fischer, Synops. Mamm., p. 448 (Germany).
1829. [*Cervus dama*] γ. *maura* Fischer, Synops. Mamm., p. 448 (Renaming of *mauricus*).
1843. *Dama vulgaris* Gray, List Spec. Mamm. Brit. Mus., p. 181 (Renaming of *dama*).
1857. *Cervus dama* Blasius, Säugethiere Deutschlands, p. 453.
1874. *Dama platyceros, niger* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LXIX, pt. I, p. 553 (Renaming of *mauricus*).
1874. *Dama platyceros, varius* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LXIX, pt. I, p. 555 (Germany).
1874. *Dama platyceros, albus* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LXIX, pt. I, p. 555 (Renaming of *leucæthiops*).
1885. [*Dama*] *dama* Lataste, Actes Soc. Linn. de Bordeaux, XXXIX, p. 288.
1910. *Dama dama* Trouessart, Faune Mamm. d'Europe, p. 229.

Type locality.—Sweden (introduced).

Geographical distribution.—Mediterranean region of Europe and Asia Minor; semi-domesticated in central Europe as far north as England and southern Sweden.

Diagnosis.—Height at shoulder about 1 mm.; back and sides in summer fawn colour with numerous whitish spots, in winter uniform greyish (melanism and albinism not infrequent); underparts and inner surface of ear whitish at all seasons; blackish dorsal line continued to end of tail; spots at each side of dorsal line distinct, not tending to become confluent; antlers with brow tine large,

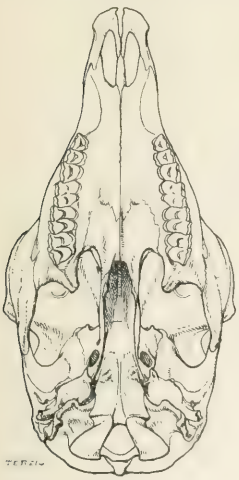


FIG. 204.
Dama dama. × ⅛.

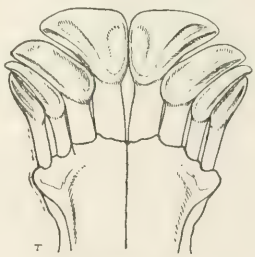


FIG. 205.
Dama dama. Incisiform teeth. Nat. size.

and with region of trez tine showing no tendency to become flattened.

Measurements.—Adult male: head and body, 1540; tail,

190 ; pencil, 100 ; hind foot (with hoof), 435 ; ear from crown, 165 ; width of ear at middle, 90. For cranial measurements see Table, p. 983.

Specimens examined.—Sixty-seven, from the following localities :—
ENGLAND : As enumerated below, 62.
SWEDEN : No exact locality, 1 (U.S.N.M.).
GERMANY : No exact locality, 1.
LOCALITY UNKNOWN ; Three (U.S.N.M.)

♂ st.	Woburn, Bedfordshire, England.	Duke of Bedford (P).	96. 9. 24. 1.
♂ st.	Tring Park, Hertfordshire.	Hon. Walter Rothschild (P).	98. 10. 18. 1.
♂ st.	England.	Purchased (Leadbeater).	
♂ st.	England.	Purchased (Baker).	46. 10. 23. 11.
2 ♂ st.	England.	No history.	
3 pairs antlers.	England.		693. a. b. d.
antlers.	Nannan Park, Merionethshire.	J. E. Harting (P).	88. 6. 12. 3.
46 antlers.	New Forest.	Mrs. Smyth (P).	50. 2. 5. 1–46.
♂ skull.	England.	Purchased.	50. 11. 13. 15.
♀ skull.	England.		693. k.
2 ♂ 2 ♀ skulls.		Lidth de Jeude Coll.	67. 4. 12. 234, 235, 236, 241.
♂ st.	Italy.	Purchased (Lefebvre).	43. 12. 29. 4.

Genus **CAPREOLUS** Gray.

1821. *Capreolus* Gray, London Med. Repos., XV, p. 307, April 1, 1821.
1837. *Capræa* Ogilby, Proc. Zool. Soc. London, 1836, p. 135, June 27, 1837.
1857. *Capreolus* Blasius, Säugethiere Deutschlands, p. 457.

Type species. —*Cervus capreolus* Linnæus.

Geographical distribution.—Central and southern Europe from Great Britain and southern Scandinavia eastward ; in Asia east to the Pacific coast.

Characters. —Telemetacarpalian deer of small size with narrow, elongate hoofs, maxillary canines normally absent,* lower incisors distinctly though not excessively differentiated in size and form, lachrymal vacuity large, the pit reduced to a shallow, inconspicuous depression ; vomer low posteriorly, showing no tendency to divide the posterior nares into two chambers ; antler small,† first appearing about a year after birth, erect, terete, without brow tine, the prongs normally three, the pedicle appearing to arise further back than in *Cervus*, but its anterior base extending over orbital cavity ; tail reduced to an inconspicuous papilla ; muzzle naked ; young with spotted coat very different from pelage of adult.

* For account of their occasional occurrence see Kölliker, Würzburger Naturwiss. Zeitschr., VI, p. 82, 1866.

† Sometimes present in females (see Sherren, Field, London, CXIV, p. 751, October 23, 1909).

Remarks.—About a dozen forms of *Capreolus* have been described. One species, represented by four geographical races, occurs in Europe.

CAPREOLUS CAPREOLUS Linnæus.

(Synonymy under subspecies.)

Geographical distribution.—From Great Britain eastward into Asia (eastern limit of range not known), and from the Mediterranean coast north to Scotland and central Sweden.

Diagnosis.—Size small (condylobasal length of skull in adult male about 150 to 160 mm.); ear slender, uniform greyish or reddish on outer side; antlers not normally attaining special massiveness; teeth strictly brachyodont, the height of crown of middle upper premolar less than diameter of crown in line of tooth-row; summer and winter pelages strikingly different, the former reddish,

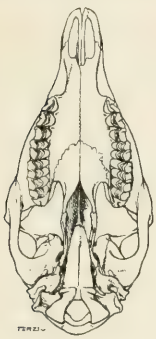


FIG. 206.
Capreolus capreolus.
× ¼.

FIG. 207.
Capreolus capreolus.
Incisiform teeth. Nat. size.

the latter grey with well developed white speculum; lips and sides of muzzle always blackish, the chin and front of muzzle at each side of naked area white in conspicuous contrast.

Remarks.—In western Europe *Capreolus capreolus* is represented by four well-defined local races.

KEY TO THE EUROPEAN FORMS OF *CAPREOLUS CAPREOLUS.*

General colour of face distinctly darker than that of body (Great Britain)..... *C. capreolus thotti*, p. 975.
General colour of face not darker than that of body.
Pale throat patch and neck patch in winter pelage sharply defined whitish (South-eastern Europe)..... *C. capreolus transsylvanicus*, p. 975.
Pale throat patch and neck patch in winter pelage obscure, yellowish or greyish.
General colour of winter pelage decidedly yellowish (Southern Scandinavia)..... *C. capreolus capreolus*, p. 974.
General colour of winter pelage a coarsely grizzled grey without decided yellowish tinge (Spain)..... *C. capreolus canus*, p. 975.

Capreolus capreolus capreolus Linnæus.

1758. [*Cervus*] *capreolus* Linnæus, Syst. Nat. I, 10th ed., p. 68 (Sweden).
1792. *C[ervus] capreolus albus* Kerr, Anim. Kingd., p. 302 (Franche Comté, France).
1829. ? *Capreolus dorcas* Burnett, Quart. Journ. Sci. Lit. Art, 1829, pt. 2, p. 353 (nomen nudum).
1843. *Capreolus capræa* Gray, List. Spec. Mamm. Brit. Mus., p. 176 (Renaming of *capreolus*).
1844. *C[apreolus] europæus* Sundevall, Öfversigt af Kongl. Vetensk.-Akad. Förhandl., Stockholm, I, p. 184 (Renaming of *capreolus*).
1845. *C[ervus] capreolus plumbeus* Reichenbach, Vollstandigste Naturgesch. der In- und Auslands, Säugeth., III, pl. III *bis*, fig. 53 (Germany).
1857. *Capreolus capreolus* Blasius, Säugethiere Deutschlands, p. 457.
1860. *Capreolus vulgaris* Fitzinger, Wissensch.-pop. Naturgesch. der Säugethiere, IV, p. 192 (Renaming of *capreolus*).
1874. *Capreolus vulgaris, niger* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LXX, Abth. I, p. 247 (Germany).
1874. *Capreolus vulgaris, varius* Fitzinger, Sitzungsber. kais. Akad. Wissensch. Wien, Math.-Naturwiss. Classe, LXX, Abth. I, p. 247 (Germany).
1910. *Capreolus capreolus* Trouessart, Faune Mamm. d'Europe, p. 233.

Type locality.—Sweden.

Geographical distribution.—Originally confined to southern Sweden but now somewhat extended artificially to the north and west.

Diagnosis.—Throat patch indistinct; general colour in winter pelage grey decidedly tinged with yellow.

Measurements.—For cranial measurements see Table, p. 983.

♂ st.	France.	——	——
2 ♂, 1 ♀.	Ferrières, Seine-et-Marne.	Hon. N. C. Rothschild (P).	10. 11. 17. 1.* 11. 11. 18. 1.* 12. 1. 17. 1.*
♂.	Armandvilliers, Seine-et-Marne.	Hon. N. C. Rothschild (P).	11. 12. 5. 1.*
♀.	Skabersjö, Sweden.	Dr. Einar Lönnberg (P).	10. 10. 18. 1.
♂ st. (melano), ♀, 1 separate skull.	Westphalia.	Purchased (Gerrard).	76. 5. 4. 1-3.*
3 skulls.	S. Germany.	Dr. A. Günther (C).	59. 9. 6. 107-109.*
15 pairs of antlers.	Bavaria.	F. N. A. Fleischmann (P).	11. 9. 13. 1-15.*
♂ head st.	Austria.	Col. R. W. Shipway (P).	98. 10. 12. 1.*
2 ♀.	Csehtelek, Bihar Comitat, Hungary.	Hon. Mrs. Charles Rothschild (P).	10. 12. 4. 1.* 11. 1. 14. 11.*
7 skulls.	——	Lidth de Jeude Collection.	67. 4. 12. 225-231.*

* Not determined by the author.—O. T.

Capreolus capreolus transsylvanicus Matschie.

1907. *Capreolus transsylvanicus* Matschie, Das Weidwerk in Wort und Bild, XVI, p. 224, March 15, 1907.

Type locality.—Bana, Roumania.

Geographical distribution.—Eastern Europe, westward to the Italian Alps.

Diagnosis.—Pale throat patch sharply defined; general colour in winter pelage clear grizzled grey.

Measurements.—For cranial measurements see Table, p. 984.

Specimens examined.—Four, from Padola, Cadore, Italy (B.M. and U.S.N.M.).

Remarks.—In its decidedly grey colour this form differs noticeably from true *capreolus* and agrees with the description and figure of *transsylvanicus*. It is distinguishable from the equally grey *canus* by the sharply defined white throat patch.

2 ♀ Padola, Cadore, Venetian Alps. Turin Museum (E.) 9.1.18.3-4.

Capreolus capreolus canus Miller.

1910. *Capreolus capreolus canus* Miller, Ann. and Mag. Nat. Hist., 8th ser., VI, p. 460, November, 1910. Type in British Museum.

Type locality.—Quintanar de la Sierra, Burgos, Spain.

Geographical distribution.—Iberian Peninsula.

Diagnosis.—Like *C. capreolus capreolus* in respect to the obscurely defined pale neck patch, but general colour in winter pelage a coarsely grizzled grey without decided yellowish tinge.

Measurements.—Type and a second adult male from the type locality: head and body, 1220 and 970; hind foot, 305 and 330; hind foot including hoof, 355 and 370; ear, 120 and —. For cranial measurements see Table, p. 983.

Specimens examined.—Eight, all from Pinares de Quintanar de la Sierra, Burgos, Spain (B.M. and U.S.N.M.).

3 ♂, 2 ♀. Pinares de Quintanar de la Sierra, Burgos, Spain. S. & N. Gonzalez (c). 8. 7. 7. 27–31. (8. 7. 7. 28. *Type* of subspecies.)

Capreolus capreolus thotti Lönnberg.

1910. *Capreolus capreolus thotti* Lönnberg, Ann. and Mag. Nat. Hist., 8th ser., VI, p. 297, September, 1910. Type in British Museum.

Type locality.—Arndilly, Craig Ellachie, Morayshire, Scotland*.

Geographical distribution.—Great Britain.

* The locality of the type specimen was accidentally recorded as Aberfeldy in the original description.—O. T.

Diagnosis.—Differs from *C. capreolus capreolus* in general darker colour, this particularly noticeable in the face, which is darker than body, a peculiarity not occurring in other European races.

Measurements.—Head and body (of type), 1150 mm.; hind foot, 330; ear, 127. For cranial measurements see Table, p. 983.

♂ head st.	Nairn, Scotland.	Earl Cawdor (P).	93. 1. 3. 1.
♂, ♀.	Nairn.	Earl Cawdor (P).	8. 8. 18. 1–2.
♂ skeleton.	Nairn.	Earl Cawdor (P).	85. 10. 6. 1.
♀ skull.	Nairn.	Earl Cawdor (P).	85. 10. 6. 2.
♂, ♀.	Arndilly, Craig Ellachie, Morayshire.	W. S. Menzies (P). (8. 11. 22. 1. *Type* of subspecies.)	8. 11. 22. 1–2.
♂, ♀ heads st.	Poltalloch, Argyllshire.	Col. E. D. Malcolm (P).	7. 6. 6. 1–2.
♂, ♀.	Thornhill, Dumfriesshire.	H. S. Gladstone (P).	11. 2. 22. 1–2.
♂ st.	Scotland.	Earl of Derby (P).	66. k.
Frontlet and antlers.	Scotland.	Gen. Hardwicke (P).	688. d.
2 frontlets and antlers.	Scotland.		688. a–b.
♂ st.		Purchased (R. Ward).	97. 12. 11. 2.
♂ st.	Whatcombe, Blandford, Dorset.	J. C. Mansel Pleydell (P).	97. 8. 21. 1.

Genus **ALCES** Gray.

1821. *Alces* Gray, London Med. Repos., xv, p. 307, April 1, 1821.

1841. *Alcelaphus* Gloger, Hand- u. Hilfsbuch der Naturgesch, i, p. 143 (Substitute for *Alces*). Not of Blainville, 1816.

1857. *Alces* Blasius, Säugethiere Deutschlands, p. 434.

1902. *Paralces* Allen, Bull. Amer. Mus. Nat. Hist., xvi, p. 160, July 1, 1902 (Substitute for *Alces* assumed to be a homonym of *Alce* Blumenbach, 1799).

Type species.—*Cervus alces* Linnæus.

Geographical distribution.—Northern forested portions of both hemispheres; in the Old World west to Norway and south to eastern Germany.

Characters. Telemetacarpalian deer of largest size with narrow, elongate hoofs, maxillary canines absent in both sexes,* lower incisors (fig. 209) scarcely differentiated in form and not much contrasted in size, lachrymal vacuity widely open, the pit well developed, small, vomer low posteriorly, showing no tendency to divide the posterior nares into two cavities, premaxillary region of skull greatly lengthened and nasal region shortened, so that distance from front of nasal to front of premaxillary is about equal to that from back of nasal to back of occiput; antlers conspicuously palmate, present in male only;

* Sometimes present in a rudimentary condition (see Lönnberg, *Zool. Anzeiger*, xxviii, pp. 448–449, January 17, 1905).

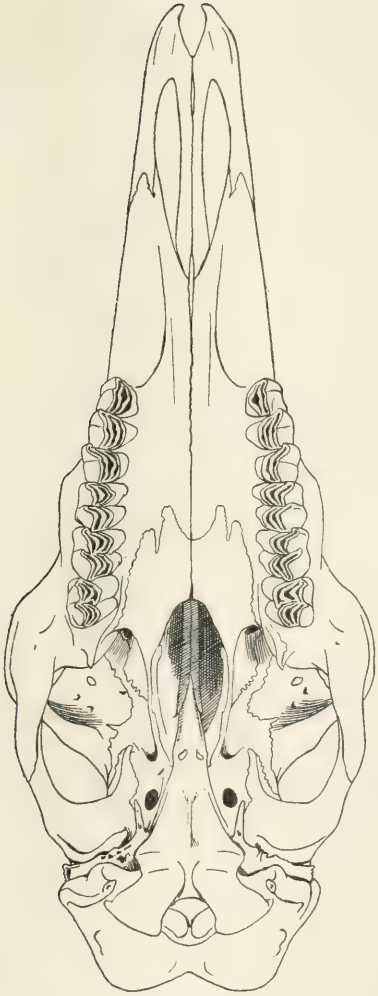


FIG. 208.
Alces alces. × ¼.

general form heavy, the shoulders high; upper lip conspicuously produced in front; muzzle hairy except for a very small median bare spot; throat of male with pendant flap of skin; young not spotted with white, their colour essentially like that of adults.

Remarks.—The genus *Alces* contains four currently recognized species or geographical forms, two in America and two in the Old World. Only one occurs in Europe.

ALCES ALCES Linnæus.

1758. [*Cervus*] *alces* Linnæus, Syst. Nat., I, 10th ed., p. 66.
1829. ? *Alces europæus* Burnett, Quart. Journ. Sci. Lit. Art, 1829, 353 (nomen nudum).
1836. *Alces machlis* Ogilby, Proc. Zool. Soc. London, p. 135 (Renaming of *alces*).
1842. *Alces antiquorum* Rüppell, Museum Senckenbergianum, III, p. 183 (Renaming of *alces*).
1843. *Alces palmatus* Gray, List Spec. Mamm. Brit. Mus., p. 182 (Renaming of *alces*).
1857. *Alces palmatus* Blasius, Säugethiere Deutschlands, p. 434.
1860. *Alces jubata* Fitzinger, Wissensch.-pop. Naturgesch. der Säugethiere, IV, p. 86 (Renaming of *alces*).
1898. *Alces alces* Lydekker, Deer of all Lands, p. 54.
1910. *Alces alces* Trouessart, Faune Mamm. d'Europe, p. 270.

Geographical distribution.—Forested portions of northern and central Europe; now confined, in the region west of Russia, to the wilder parts of the Scandinavian Peninsula and eastern Germany.

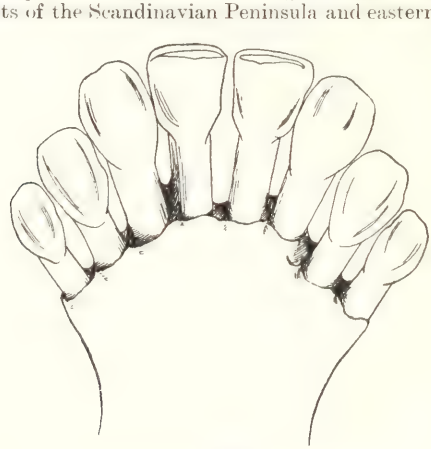


FIG. 209.
Alces alces. Incisiform teeth. Nat. size.

Diagnosis.—General characters as in the genus *Alces;* height at shoulder about two meters; general colour brown, lighter and

approaching wood-brown on head, back, and legs, darker, almost blackish on tail, throat, and underside of body.

Measurements. — Adult male from Stenkjær, Trondhjem, Norway: head and body about 2900; tail, 95; hind foot, 855; ear, 330; height at shoulder, 1900. For cranial measurements see Table, p. 984.

Specimens examined.—Twelve, from the following localities:—
NORWAY: Stenkjær, Trondhjem, Norway, 1 (U.S.N.M.). No exact locality, 1 (U.S.N.M.).
SWEDEN: No exact locality, 9 (B.M. and U.S.N.M.). Udoholm 1.

Single antler.	Udoholm, Sweden.	Earl of Selkirk (P).	703. d.
♂ antlers.	Sweden.	College of Surgeons (P). (From the Leverian Museum.)	703. e.
7 pairs of antlers.	Sweden.	Purchased.	3. 11. 21. 1–7.

Genus **RANGIFER** Hamilton Smith.

1827. *Rangifer* Hamilton Smith, Griffith's Cuvier, Animal Kingdom, v, p. 304.
1827. *Tarandus* Billberg, Synopsis Faunæ Scandinaviæ, i, p. 22.
1838. *Procerus* Serres, Essai sur les Cavernes à Ossements, 3rd ed., p. 143.
1840. *Procervus* Blainville, Comptes Rendus, Acad. Sci., Paris, xi, p. 392 (Substitute for *Procerus*).
1845. *Achlis* Reichenbach, Vollständigste Naturgesch. des In- und Auslands, Säugeth., iii, p. 12 (Alternative for *Tarandus*).

Type species.—*Cervus tarandus* Linnæus.

Geographical distribution. — Northern forests and barren grounds of both hemispheres; in the Old World north to Spitzbergen; Novaya Zemlaya?

Characters.—Telemetacarpalian deer of medium size, with lateral hoofs functional and main hoofs so broadened that the outline of the two together is nearly circular, maxillary canine present in both sexes; lower incisors (fig. 211) relatively smaller than in other recent deer, slightly differentiated in both size and form; lachrymal vacuity large, the pit shallow and ill-defined; vomer high posteriorly, completely dividing posterior nares into two chambers; skull normal in general form, but orbital cavities not pushing back under bases of horn pedicles; antlers usually present in both sexes, beginning to develop within four or five weeks after birth, the beam slender and curved, slightly palmate distally; muzzle entirely hairy; young not spotted with white, their colour essentially like that of adults.

Remarks.—About sixteen forms of living Reindeer have been described, most of them from North America. At least three occur in western Europe or have done so within very recent times.

KEY TO THE EUROPEAN SPECIES OF *RANGIFER*.

Size small, upper length of skull less than 225 mm. (Spitzbergen)..... *R. platyrhynchus*, p. 985.
Size large, upper length of skull about 270–300 mm.
Upper length of skull in adult male 270–290 mm.; upper tooth-row about 95 mm. (treeless alpine portions of Norway and formerly of Sweden, now rare except in captivity)..... *R. tarandus*, p. 980.
Upper length of skull in adult male about 300 mm.; upper tooth-row about 85 mm. (wooded portions of northern Finnland and formerly of northern Sweden) ..... *R. fennicus*, p. 981.

RANGIFER TARANDUS Linnæus.

1758. [*Cervus*] *tarandus* Linnæus, Syst. Nat., I, 10th ed., p. 67.
1789. [*Cervus tarandus*, α *rangifer* Gmelin, Syst. Nat., I, 13th ed., p. 177.
1827. *Tarandus lapponum* Billberg, Synopsis Faunæ Scandinaviæ, I, p. 22 (Renaming of *C. tarandus*).
1842. *Tarandus borealis* Rüppell, Museum Senckenbergianum, III, p. 183 (Renaming of *C. tarandus*).

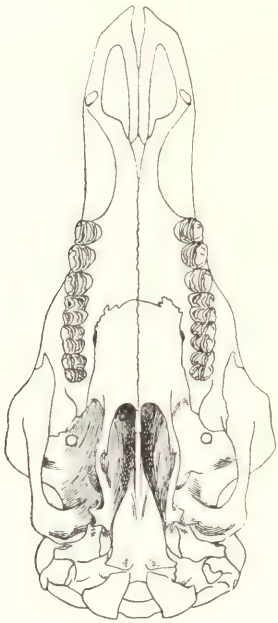


FIG. 210.
Rangifer tarandus. × ¼.

1852. *Tarandus furcifer* Baird, Rep. Comm. Patents, 1851, II, Agric., p. 109 (Renaming of *tarandus*).

1902. [*Rangifer tarandus*] var. *cylindricornis* Camerano, Mem. Reale Accad. Sci. Torino, 2nd ser., LI, p. 167 (Renaming of true *tarandus*).

1910. *Rangifer tarandus* Trouessart, Faune Mamm. d'Europe, p. 231.

Type locality.—Alpine region of Swedish Lapland.

Geographical distribution.—Formerly the entire alpine region of the Scandinavian Peninsula; now confined in the wild state to two widely separated districts in Norway; west Finmarken in the north, and the main high mountain region in the south. Extensively domesticated throughout Scandinavian Lapland.

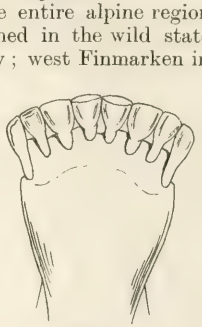


FIG. 211.
Rangifer tarandus. Incisiform teeth. Nat. size.

Diagnosis.—Size rather large (height of adult male at shoulder about 1150 mm.; upper length of skull 270–290 mm.); skull with nasal bones broad and little arched; teeth relatively large (upper tooth-row 94–98; lower tooth-row 101–104 mm.); general colour a greyish or drab brown above, buffy whitish beneath and on muzzle; a darker longitudinal area on side of body; tail buffy white with dark median line.

Measurements.—Adult male from Heimdalen, Norway: head and body, 2000±, tail, 150; hind foot, 450±; ear, 100±. For cranial measurements see Table, p. 984.

Specimens examined.—Nine, from the following localities:—
NORWAY: Heimdalen, Norway, 1 (U.S.N.M.), wild; no exact locality, 1 (U.S.N.M.), tame; B.M. specimens as enumerated below.

Remarks.—The material examined is too limited to form the basis of any discussion of the various forms of wild and tame reindeer.

♂ st.	Loerdal Mts., Sogne Fjord, Norway.	Sir W. J. Ingram (C & P).	87. 9. 20. 1.
♂ & ♀ antlers.	Loerdal Mts.	Sir W. J. Ingram (C & P).	87. 9. 20. 2–3.
♂ st. & skeleton.	Fillefjeld, Norway.	Chas. Ingram (C & P).	79. 10. 9. 1.
♀ st. & skeleton.	Fillefjeld, Norway.	Sir W. J. Ingram (C & P).	81. 9. 28. 2.
♀.	Norway.	Chas. Ingram (C & P).	75. 10. 30. 1.
♀ (ad. & yg.).	Norway.	J. C. Ingram (C & P).	83. 7. 28. 1–2.

RANGIFER FENNICUS Lönnberg.

1909. *Rangifer tarandus fennicus* Lönnberg, Arkiv för Zoologi, VI, No. 4, p. 10, July 14, 1909.

Type locality.—Torne, Lappmark ("thus probably in Enontekis," *fide* Lönnberg), Finnland.

Locality.	Number.	Sex.	Condylobasal length.	Occipitonasal length.	Zygomatic breadth.	Greatest breadth over orbits.	Nasal (median).	Greatest breadth of both nasals together.	Occipital depth.	Palatal depth at level of m^3.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Posterior upper molar.	Posterior lower molar.	Observations.
Cervus elaphus germanicus.																
Italy: Cadore	4867 Turin	♂	363·0	—	145·0	158·0	116·0	43·0	—	80·0	308·0	121·0	135·4	25·8×22·6	34·0×14·0	m^3 slightly worn.
C. elaphus atlanticus.																
Norway: Gloppen	143179	♂	366·0	318·0	152·0	168·0	120·0	43·0	85·0	87·4	305·0	108·0	110·0	22·0×23·0	26·0×14·0	,, ,,
,,	144070	♂	355·0	330·0	150·0	163·0	131·0	55·0	79·0	86·0	310·0	99·0	108·0	20·6×21·0	25·0×11·4	,, ,,
C. elaphus scoticus.																
Scotland: I. of Jura	96. 12. 21. 2	♂	332·0	288·0	145·0	153·0	116·0	41·6	70·0	76·0		92·6	—	20·2×20·8		,, much worn.
Balmacaan	9. 1. 15. 1	♂	324·0	282·0	143·0	141·5	120·0	54·5	82·0	68·0	272·0	96·0	118·5	18·5×18·5	26·0×12·0	,, moderately worn.
,,	9. 1. 15. 2	♀	309·0	260·0	131·0	120·0	103·0	47·0	72·0	62·0	263·0	86·0	102·5	18·0×19·5	26·5×11·5	,, much worn.
C. elaphus hispanicus.																
Spain: Huelva	95. 9. 4. 14	♂	348·0	327·0	143·0	151·0	126·0	40·0	71·4	88·0	302·0	100·0	116·0	22·6×17·2	29·8×14·0	,, moderately worn.
,,	8. 3. 8. 14	♂	—	298·0	132·0	145·0	118·0	36·0	—	81·0	290·0	90·4	108·6	20·0×19·6	28·8×12·4	,, much worn.
,,	8. 3. 8. 15	♂	322·0	295·0	136·0	141·0	—	—		80·0	275±	97·0	104·6	21·0×18·2	23·8×11·0	,, moderately worn.
Burgos	155619	♂	364·0	325·0	145·0	168·0	128·0	45·4	75·0	81·4	303·0	104·0	118·0	24·6×21·6	31·4×13·0	,, slightly worn.
,,	155620	♀	339·0	305·0	124·0	134·0	123·0	36·4	67·6	73·2	283·0	109·4	118·6	22·8×20·0	30·2×13·0	,, ,,

C. elaphus corsicanus.																			
Corsica: Villagrande .	5066 Turin	♂	322·0	300·0	139·0	157·0	113·0	46·0	63·0	74·0	275·0	103·0	113·6	23·0×16·6	29·0×13·0	m^3 slightly worn.			
Dama dama.																			
England . . .	46. 1. 1. 4	♂	262·0	—	121·0	136·0	78·8	36·0	66·0	—	214·0	74·0	85·6	18·4×17·0	—	,, moderately worn.			
Sweden. . . .	2161 U.S.N.M.	♀	236·0	208·0	102·4	106·6	70·0	29·0	59·4	—	198·0	82·4	87·4	19·8×15·6	22·6×11·2	,, ,,			
Germany . . .	693 *q*	♀	243·0	—	101·0	112·4	76·4	30·6	58·0	—	198·0	69·0	78·4	16·8×16·8	—	,, ,,			
Washington, D.C. (Park)	144055	♀	238·0	198·0	102·0	110·0	74·0	27·6	58·0	60·0	195·0	81·6	86·4	21·4×18·0	24·6×11·2	,, much worn.			
,, ,,	155611	♂	275·0	250·0	119·6	131·0	86·2	36·4	—	66·5	—	76·0	—	17·6×19·2	—	,, excessively worn.			
C. capreolus capreolus.																			
Sweden: Skabersjö .	Stockholm	♀	185·4	159·2	84·2	91·4	59·0	29·6	42·8	—	156·8	54·0	65·0	11·0×11·2	15·6× 8·2	,, moderately worn.			
,, .	10. 10. 18. 1	♀	189·0	161·4	81·2	86·2	55·0	24·8	48·6	—	160·0	53·2	61·8	10·0×11·0	14·6× 7·4	,, ,,			
C. capreolus thotti.																			
Scotland: Nairn . .	85. 10. 6. 2	♀	—	—	87·4	90·4	—	29·0	47·4	—	—	57·2	—	11·0×13·2	—	,, ,,			
,, . .	8. 8. 18. 2	♀	173·0	150±	82·8	82·0	45±	24·4	45·8	54·8	150·4	56·4	60·8	11·2×12·8	14·8× 8·0	,, much worn			
Arndilly .	8. 11. 22. 1*	♂	176·0	149·0	87·5	—	50·0	25·5	52·0	48·0	142·0	51·5	64·5	10·0×11·0	13·0× 7·5	,, moderately worn.			
,, .	8. 11. 22. 2	♀	177·0	153·5	86·0	—	50·0	26·5	52·0	46·5	147·0	56·5	65·5	11·5×12·5	16·0× 7·5	,, much worn.			
C. capreolus canus.																			
Spain: Burgos . .	8. 7. 7. 28*	♂	189±	161·0	92·0	98·8	55·0	22·4	50·0	—	164·0	55·8	66·0	11·0×12·0	16·0× 8·8	,, ,,			
,, . .	8. 7. 7. 27	♂	183·4	158·0	86·0	90·0	52·8	21·8	46·6	—	155·4	55·2	64·4	11·2×11·0	15·2× 7·4	,, moderately worn.			
,, . .	8. 7. 7. 29	♂	172·6	148·0	80·4	85·0	52·0	22·0	44·2	—	144·4	57·8	65·6	11·0×11·0	15·0× 7·6	,, slightly worn.			
,, . .	154150	♂	179·4	155·5	84·0	87·8	55·0	22·4	52·4	—	152·6	56·0	66·0	11·2×11·4	15·2× 8·0	,, moderately worn.			
,, . .	154147	♀	178·0	158·4	80·4	83·2	58·4	20·0	51·4	55·8	152·0	58·8	61·4	10·8×12·2	14·8× 8·0	,, ,,			

* Type.

CRANIAL MEASUREMENTS OF EUROPEAN *CERVIDÆ—continued.*

Locality.	Number.	Sex.	Condylobasal length.	Occipitonasal length.	Zygomatic breadth.	Greatest breadth over orbits.	Nasal (median).	Greatest breadth of both nasals together.	Occipital depth.	Palatal depth at level of m^3.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Posterior upper molar.	Posterior lower molar.	Observations.
C. capreolus transsylvanicus.																
Italy: Cadore	152012	♂	190·0	162·6	87·2	93·0	53·0	—	47·0	60·6	159·0	57·0	65·4	11·0×11·0	15·0× 9·0	
,,	152011	♀	176·0	153·0	79·0	82·0	50·0	21·6	45·6	–	149·0	57·0	67·2	11·6×11·4	16·0× 7·6	
Alces alces.																
Sweden	22698	♂	565·0	395·0	212·0	230·0	117·0	82·6	130·0	155·0	—	153·0	—	30·6×32·2	—	m^3 slightly worn.
Norway	38510	♀	512·0	322·0	184·4	190·6	108·6	66·4	112·4	125·0	451·0	148·6	164·4	23·8×28·0	38·6×20·0	,, ,,
Rangifer tarandus.																
Norway: Heimdalen	143178	♂	365·0	280·0	138·0	160·0	108·0	53·0	80·0	95·0	306·0	94·0	101·0	18·0×16·0	22·6×10·4	,, moderately worn.
Rangifer fennicus†	—		357·0‡	302·0	149·0		125·0	54·0	–	—	–	85·0	90·0	—	—	
R. platyrhynchus.																
Spitzbergen	152143	♂	—	221·0	110±	127·0	87·0	41·0	—	72·4	—	85·0	—	—	18·0×16·6	,, excessively worn.
,,	4589 Turin	♀	—	200±	115·0	133·0	82·0	49·0	—	62±	238·0	93·0	82·0		—	

† Type, from Lonnberg.

‡ Basicranial length.

Geographical distribution.—Now probably confined to the wooded portions of Finland, east to the Kola Peninsula, and nearly extinct. Formerly ranging westward into the wooded portion of northern Sweden where it is now probably represented by the large woodland race of tame reindeer found in certain districts.

Diagnosis.—Size greater than in *Rangifer tarandus* (height of adult male at shoulder about 1200 mm.; upper length of skull about 300 mm.); skull with nasal bones narrow and highly arched; teeth relatively small (upper tooth-row about 85 mm.; lower tooth-row about 90 mm.).

Measurements.—For cranial measurements see Table opposite.

Remarks.—This animal, which I know only from Lönnberg's description and figures, appears to be specifically distinct from *Rangifer tarandus.*

RANGIFER PLATYRHYNCHUS Vrolik.

1829. *Cervus* (*Tarandus*) *platyrhynchus* Vrolik, Nieuwe Verhandel. van 't Kroninke Nederl. Inst., Eerste Klasse, pt. 2, p. 160 (Spitzbergen, see Vrolik, l.c., p. 239).

1862. *Cervus tarandus* forma *spetsbergensis* Andersén, Öfversigt af Kongl. Vetensk.-Akad. Förhandl., Stockholm, XIX, p. 457, October 8, 1862.

1866. [*Rangifer arcticus*] var. *spitzbergensis* Murray, Geogr. Distrib. Mamm., p. 334, described on p. 155.

1902. *Rangifer spitzbergensis* Camerano, Mem. Reale Accad. Sci. Torino, 2d ser., LI, pp. 159–240, 1902.

1910. *Rangifer spitzbergensis* Trouessart, Faune Mamm. d'Europe, p. 232.

Type locality.—Spitzbergen.

Geographical distribution.—Spitzbergen.

Diagnosis.—Size much less than in *Rangifer tarandus* and *R. fennicus* (height at shoulder of mounted adult male in Turin Museum, 680 mm.; upper length of skull less than 225 mm.); skull with nasal bones broad and little arched, more widened anteriorly than in the continental species; teeth relatively as large as in *R. tarandus.*

Measurements.—For cranial measurements see Table opposite.

Specimens examined.—Two mounted individuals and six skulls (U.S.N.M. and Turin).

Remarks.—The Spitzbergen Reindeer is sharply and completely differentiated from both of the species occurring in continental Europe.

Family BOVIDÆ.

1821. *Bovidæ* Gray, London Med. Repos., xv, p. 308, April 1, 1821.

Geographical distribution.—Africa; southern Europe (within historic times north to the Baltic and west to Great Britain); Asia, including Japan and the larger Malay Islands; North America from Greenland to northern Mexico (recently exterminated over much of its former range).

Characters.—Artiodactyles with frontal appendages usually occurring in both sexes, always, when present, in the form of permanent horns supported by bony cores arising from the frontal bones; molars usually (always in European members of the family) hypsodont; lateral digits rudimentary or absent, usually represented by the hoofs alone.

Remarks. The family *Bovidæ* is richer in both genera and species than any other group of existing ungulates. About fifty genera are usually recognized, three of which, *Ovis*, *Capra* and *Rupicapra*, now occur naturally in western Europe.*

Genus **OVIS** Linnæus.

1758. *Ovis* Linnæus, Syst. Nat., I, 10th ed., p. 70.
1762. *Aries* Brisson, Regn. Anim. in Cl. IX distrib., 2nd ed., p. 12.
1776. *Musimon* Pallas, Spicil. Zoologica, II, fasc. 11, p. 8 (*M. asiaticus*).
1798. *Musmon* Schrank, Fauna Boica, I, p. 81 (Substitute for *Ovis*).
1795. *Aries* Link, Zool. Beyträge, I, pt. II, p. 96 (part).
1816. *Ammon* Blainville, Bull. Soc. Philomathique, Paris, p. 76, May, 1816 (Alternative name for *Ovis*).
1857. *Ovis* Blasius, Säugethiere Deutschlands, p. 466.

Type species.—*Ovis aries* Linnæus (by tautonymy).

Geographical distribution. Holarctic region from Cyprus and Asia Minor eastward across central and northern Asia, and in western North America from Alaska to northern Mexico; one species isolated in the Mediterranean portion of Europe.

Characters.—*Bovidæ* of small size and rather heavy form, the tail normally short, the pelage dense, not tending to special elongation on chin, throat and neck; feet with glands between the hoofs; skull conspicuously wedge-shaped in general outline from wide orbital region to narrow rostrum; occipital region abruptly bent downward, the upper surface concave or nearly flat, the portion behind zygomata frequently almost tubular in general form; lachrymal pit present; nasal branch of premaxillary not wedged between nasal and maxillary; horns always present in males, usually absent or rudimentary in females, very robust

* The genera *Bos* and *Bison* have become extinct within historic times; a species of *Bubalus*, introduced in the seventeenth century, exists in a wild or semi-feral state in parts of Italy.

at base, the under surface concave, the general form usually an outwardly directed spiral ; teeth strongly hypsodont, the upper molars without supplementary pillars in re-entrant angles, the outer side of upper premolars with both terminal and median ridges well developed ; lower incisors with crowns elevated, the width of i_1 when unworn not more than height.

Remarks.—The genus *Ovis* contains about forty described species, mostly Asiatic. Only one is definitely known to occur wild in Europe.

OVIS MUSIMON Pallas.

1811. *Ægoceros musimon* Pallas, Zoogr. Rosso-Asiat., I, p. 230 (Sardinia).
1829. [*Ovis musimon*] B var. *occidentalis* Brandt and Ratzeburg, Getreue Darstellung und Beschreibung der Thiere, p. 55 (Corsica).
1841. *Ovis musmon* Bonaparte, Iconogr. Faun. Ital., Indice distrib.
1857. *Ovis musimon* Blasius, Säugethiere Deutschlands, p. 471.
1905. ? *Ovis matschiei* Duerst, Martin Wilckens Grundzüge der Naturgesch. der Haustiere, 2nd ed., p. 180 (Corsica and Sardinia).
1910. *Ovis musimon* Trouessart, Faune Mamm. d'Europe, p. 242.

Type locality.—Sardinia.

Geographical distribution.—Corsica and Sardinia.

Diagnosis.—Size decidedly less than in ordinary domestic sheep (head and body of rams about 1300 ; condylobasal length of skull about 225 mm.) ; general colour of back and sides reddish brown ; a blackish median stripe on neck and shoulders, this spreading as a dark shade over sides behind shoulders ; a conspicuous greyish white patch on posterior half of sides ; underparts of body and inner surface of legs dull whitish ; under surface of neck with conspicuous black area, this continued broadly down forearm and as a narrow stripe nearly to hoof ; colour of side separated from that of belly by a black stripe beginning at axilla and extending down outer side of hind leg to heel ; tail black above, whitish below ; skull small, with shallow indistinct lachrymal pits ; horns occasionally present in female,* those of male curved in a single plane or with tip bent either outward or inward.

Measurements.—Adult males from Sardinia and Corsica (skins) : head and body, 1270 and 1300 ; tail, 55 and 60 ; hind foot, 220 and 240 ; ear, 70 and 70. For cranial measurements see Table, p. 996.

Specimens examined.—Sixteen from Sardinia (B.M., U.S.N.M., and Genoa) and two from Corsica (B.M. and U.S.N.M.).

Remarks.—Two species of *Ovis* are recognized by Duerst as occurring together in both Corsica and Sardinia. Their characters are said to be as follows :—

* See Lydekker, Field, London, CX, pp. 147, 197, and Bernard, ibid., p. 147.

Ovis musimon: foxy red with brown stripe on back, white spots (Flecken) on head and flanks; horns light coloured, curved in a single plane.

Ovis matschiei: more brownish grey in general colour, the face ash-grey rarely marked with white; horns dark brown, curved in a spiral with tips directly strongly outward.

It seems not improbable that the Corsican form (*occidentalis*) will prove to be distinct from true *Ovis musimon*. The single male skin examined shows no appreciable peculiarities; but the females are said to be usually if not always horned, a condition which rarely or never occurs in the Sardinian race.

♂ st.	Gennargentu Mts., Sardinia.	Ford G. Barclay (C & P).	95. 4. 4. 1.
♂, ♀.	Gennargentu Mts. (*P. Bonomi.*)	E. N. Buxton (P).	95. 4. 16. 6–7.
yg.	Sardinia.	A. B. Bayley-Worthington (C & P).	5. 3. 6. 2.
♂ st.	——	Zoological Society.	53. 8. 29. 49.
2 ♀.	——	Zoological Society.	61. 3. 24. 2. 62. 12. 22. 2.
♂ skeleton.	——	Zoological Society.	60. 4. 23. 1.
♂ skull.	(*W. Ewer.*)	Zoological Society.	55. 12. 26. 162.
♂ horns.	Corsica.	Dr. C. I. Forsyth Major (C).	9. 1. 11. 1.

Genus **CAPRA** Linnæus.

1758. *Capra* Linnæus, Syst. Nat., I, 10th ed., p. 68 (*hircus*, by tautonymy).
1762. *Hircus* Brisson, Regn. Anim. in Classis IX distrib., 2nd ed., p. 12 (*Hircus* Brisson = *Capra hircus* Linnæus).
1766. *Ibex* Pallas, Spicil. Zoologica, II, fasc. 11, p. 31 (*sibiricus*).
1795. *Aries* Link, Zool. Beyträge, I, pt. 2, p. 96 (Substitute for *Capra*).
1798. *Tragus* Schrank, Fauna Boica, I, p. 80 (Substitute for *Capra*).
1811. *Ægoceros* Pallas, Zoogr. Rosso-Asiat., I, p. 224.
1857. *Capra* Blasius, Säugethiere Deutschlands, p. 474.

Type species.—*Capra hircus* Linnæus.

Geographical distribution. Mediterranean region of Europe (Portugal, Spain, Pyrenees, Alps and Grecian Archipelago) eastward through the Caucasus, Asia Minor and north-eastern Africa to central Asia.

Characters.—Like *Ovis* externally but hind feet without glands, males bearded, and horns never forming an outward or inward spiral; skull without lachrymal pit; upper extremity of premaxillary deeply wedged between nasal and maxillary; brain-case conspicuously convex above; outer side of upper premolars with terminal and median vertical ridges obsolete.

Remarks. About thirty-five species are currently referred to the genus *Capra*. Half a dozen of these occur in the Mediterranean region of Europe.

CAPRA IBEX Linnæus.

1758. [*Capra*] *ibex* Linnæus, Syst. Nat., I, 10th ed., p. 68.
1786. *Capra alpina* Girtanner, Observ. et Mém. sur la Phys., l'Hist. Nat. et les Arts, XXVIII, p. 224, March, 1786.
1857. *Capra ibex* Blasius, Säugethiere Deutschlands, p. 475.
1906. *I*[*bex*] *ibex* Camerano, Mem. Accad. Reale Sci. Nat., Torino, 1905–1906, p. 284.
1910. *Capra ibex* Trouessart, Faune Mamm. d'Europe, p. 236.
1912. *Capra ibex graicus* Matschie, Deutsche Jägu. Zeitung, LIX, no. 8, April, 1912.

Type locality.—Swiss Alps.

Geographical distribution.—Formerly throughout the Alps; now confined to a few localities in Piedmont, Italy.

Diagnosis.—Size larger than in ordinary domestic goats (head and body of males about 1350 mm.); general colour a dusky grey, darker on chin and upper part of throat and on belly; legs blackish below and along anterior surface above, this dark area not noticeably contrasted or sharply defined; tail like body at base, blackish at tip; horns very large, curved backward in a single plane, conspicuously cross-ribbed on anterior surface, but antero-internal border not elevated.

Measurements.—Adult male (mounted): head and body, 1350; tail, 155; hind foot, 310; ear, 85; height at shoulder, 760. Adult female (skin): head and body, 1000; tail, 30; hind foot, 290. For cranial measurements see Table, p. 996.*

Specimens examined.—Fifteen (B.M., U.S.N.M., and Turin).

♂ st.	Italian side of Monte Rosa.	Purchased (Rowland Ward).	97. 12. 11. 1.
♂ st.	Alps.	Purchased (Parreys).	41. 596.
♂ st.	Alps.	Mrs. A. G. Campbell (P).	650. 2.
*♂ skull.	Alps.	Messrs. Murray and Brockedon (P).	1835.
♂ horns.	Chamonix.	Purchased (Faery).	45. 12. 16. 1.
2 ♂ horns.	——	——	650. a. b.
♀ skull.	——	Purchased (Warwick).	57. 3. 18. 2.

CAPRA PYRENAICA Schinz.

(Synonymy under subspecies.)

Geographical distribution.—Formerly throughout the mountainous districts of the Iberian Peninsula and the Pyrenees. Now extinct except in isolated colonies on the south side of the

* In the elaborate Tables of cranial measurements published by Camerano, Ricerche intorno allo Stambecco delle Alpi (Mem. Accad. Reale Sci. Nat., Torino, 2nd ser., LV, pp. 283–358, 1906; ibid., LVI, pp. 1–70, 1907), there are relatively few dimensions given which are comparable with those here used. Twenty males, presumably adult, furnish the following averages and extremes: basilar length, 252·1 (242–265); nasal, 92·1 (84–100); maxillary tooth-row, 68·1 (62–76).

Pyrenees, in the Serra do Gerez, Portugal, the Sierra de Gredos, Sierra Morena, Sierra de Ronda, Sierra Nevada, Sierra Martés, and Sierra de Cardó, Spain.*

Diagnosis.—Horns curved upward, outward and backward, distinctly compressed laterally, the anterior surface without evident transverse ridges, the antero-external border raised and rib-like; colour paler than in *Capra ibex*, and dark areas sharply defined.†

Remarks.—Four local races of *Capra pyrenaica* are recognized by Cabrera in his recent paper on "The Subspecies of the Spanish Ibex." I have been unable to form any personal opinion as to the validity of these forms. The following brief synopsis is based entirely on the accounts published by Cabrera and Bocage.

Capra pyrenaica pyrenaica Schinz.

1838. *Capra pyrenaica* Schinz, Neue Denkschr. Allg. Schweiz. Gesellsch. Naturwiss., Neuchatel, II, p. 9.
1857. *Capra pyrenaica* Blasius, Säugethiere Deutschlands, p. 480.
1910. *Capra pyrenaica* Trouessart, Faune Mamm. d'Europe, p. 237.
1911. *Capra pyrenaica pyrenaica* Cabrera, Proc. Zool. Soc., London, p. 966, December, 1911.

Type locality.—Spanish Pyrenees.

Geographical distribution.—Formerly the Pyrenees and eastern part of Cantabrian chain. Now restricted to the region of Mt. Perdido, Huesca, Spain.

Diagnosis.—Dark markings maximum for the species, the lateral stripe broad, the black of withers extending downward nearly or quite to that of upper part of leg; horns widely spreading, the rib on antero-internal border abruptly defined.

♂ st. & ♀ skull.	Pyrenees.	Purchased (Boubée).	48. 2. 5. 4–5.
♀ head st.	Spain.	Capt. J. Marriott (C & P).	0. 10. 28. 1.
♂ st. (imm.).	——	Sir R. Owen (P).	50. 9. 4. 1.
1 yg.	——	Zoological Society.	68. 9. 12. 12.

* For map of present and past distribution, see Cabrera, Proc. Zool. Soc., London, 1911, p. 965, December, 1911.

† "The species, as a whole, may be described as a pale brown animal with the outer side of the limbs black, a black band on the lower part of the flanks, and a short black mane, continued along the back by a narrow stripe. The forehead and the beard are blackish or very dark brown, and the belly and inner part of the limbs white. In winter pelage there is a whitish underfur, quite absent in summer, when the ground colour is browner and the black areas become more abruptly definite. The females lack at all seasons the mane and the black markings of the head and body, presenting only a blackish tint on the anterior face of the limbs, and it is the same with the young males, in which the black areas appear in the second or third year, becoming larger and darker as the animal grows older" (Cabrera, Proc. Zool. Soc., London, 1911, p. 967, December, 1911).

Capra pyrenaica lusitanica França.

1909. *Capra lusitanica* França, Bull. Soc. Portugaise Sci. Nat., II, p. 144. Based on the "Cabra-Montez da Serra do Gerez" of Bocage, Mem. Acad. Real das Sciencias de Lisboa (Sci. Math. Phys. Nat.), N.S., II, pt. I, pp. 1–20, pls. 1–2. Articles separately paged. Bocage wrongly cited as authority for the name *lusitanica*. Type in Lisbon Museum.

1911. *Capra pyrenaica*, peculiar subspecies, Cabrera, Proc. Zool. Soc., London, p. 966, December, 1911.

Type locality.—Serra do Gerez, Minho, Portugal.

Geographical distribution.—Formerly the mountains of Galicia and northern Portugal. Now confined to the Serra do Gerez or extinct.

Diagnosis.—Horns apparently less spreading than in the other races.

Capra pyrenaica victoriæ Cabrera.

1911. *Capra pyrenaica victoriæ* Cabrera, Proc. Zool. Soc., London, p. 975, December, 1911. Type in Madrid Museum.

Type locality.—Madrigal de la Vera, southern slope of Sierra de Gredos, Province of Cáceres, Spain.

Diagnosis.—"An intermediate form, in size and in the extent of the black markings, between *C. p. pyrenaica* and *C. p. hispanica*, rather browner than *hispanica* in summer coat, and with [widely spreading] horns similar in size to that race, but comparatively broader and flatter."

Measurements.—Type, adult male, mounted (from Cabrera): head and body, 1355; tail, 130; hind foot with hoofs, 385; ear, 120; height at shoulder, 700. For cranial measurements see Table, p. 997.

Capra pyrenaica hispanica Schimper.

1848. *Capra hispanica* Schimper, Comptes-Rend. Acad. Sci., Paris, XXVI, p. 318, March, 1848.

1910. *Capra pyrenaica hispanica* Trouessart, Faune Mamm. d'Europe, p. 237.

1911. *Capra pyrenaica hispanica* Cabrera, Proc. Zool. Soc., London, p. 966, December, 1911.

Type locality.—Sierra Nevada ("Picacho de Veleta et Mulahacen"), Spain.

Geographical distribution.—Mountains of southern and eastern Spain (Sierra de Ronda, Sierra Nevada, Sierra Morena, Sierra Martés and Sierra de Cardó).

Diagnosis.—Dark markings minimum for the species, the lateral stripe very narrow, the black of withers strictly confined to median line; nasal bones more abruptly narrowed than in true

pyrenaica; horns widely spreading, less compressed than in *victoriæ*, the antero-internal rib less abruptly defined than in *pyrenaica.*

Measurements.—Adult male (from Cabrera): head and body, 1190; hind foot with hoofs, 305.

♂ st.	S. Spain.	Purchased (Parzudaki).	55. 11. 26. 14.

CAPRA ÆGAGRUS Erxleben.

1777. [*Capra*] *ægagrus* Erxleben, Syst. Regni Anim., I, p. 260 (Caucasus).
1857. *Capra ægagrus* Blasius, Säugethiere Deutschlands, p. 485.
1858. ? *Ægocerus pictus* Erhard, Fauna der Cycladen, Wirbelthiere, p. 32 (Syra, Cyclades, Greece).
1888. ? *Capra dorcas* Reichenow, Zool. Jahrb., Syst., III, p. 594, May 31, 1888. Island of Joura (Gyaros), Greece.
1899. ? *C*[*apra*] *ægagrus* var. *jourensis* Ivrea, Proc. Zool. Soc., London, p. 599. Nomen nudum.
1899. ? *Capra cretensis* Lorenz-Liburnau, Wissensch. Mitth. aus Bosnien und der Hercegovina, VI, p. 865 (Crete).
1910. *Capra ægagrus picta*, *C. ægagrus dorcas* and *C. ægagrus cretensis* Trouessart, Faune Mamm. d'Europe, pp. 238–239.

Wild representatives of the domestic goat occur on several of the islands of the Grecian Archipelago. Three local forms have been described, the status of which is very imperfectly understood. The Museum contains no material bearing on the question.

Genus **RUPICAPRA** Blainville.

1816. *Rupicapra* Blainville, Bull. Soc. Philomathique, Paris, p. 75, May, 1816.
1840. *Capella* Keyserling and Blasius, Wirbelthiere Europas, p. IV.
1841. *Cemas* Gloger, Gemeinn. Hand- u. Hilfsbuch der Naturgesch., I, p. 153 (not of Oken, 1816).
1857. *Capella* Blasius, Säugethiere Deutschlands, p. 487.

Type species.—*Capra rupicapra* Linnæus.

Geographical distribution. Mountains of the Mediterranean region from the Asturias and Pyrenees eastward to the Caucasus.

Characters.—General form less robust than in *Ovis* and *Capra;* skull with occipital region moderately bent downward, not distinctly tubular posteriorly; lachrymal pit absent; nasal branch of premaxillary not in contact with nasal; horns present and well developed in both sexes, rising almost perpendicularly, their tips hooked abruptly backward, downward and slightly outward; teeth essentially as in *Ovis,* but crowns of incisors less elongated, and outer side of upper premolars with terminal ridges well developed, but median ridge obsolete.

Remarks. Four members of the genus *Rupicapra* are now recognized, a number which will probably be increased when adequate material is brought together.

RUPICAPRA RUPICAPRA Linnæus.

1758. [*Capra*] *rupicapra* Linnæus, Syst. Nat., I, 10th ed., p. 68 (Switzerland).
1829. ? *Rupicapra hamulicornis* Burnett, Quart. Journ. Sci. Lit. Art., 1829, pt. II, p. 353 (nomen nudum).
1843. *Rupicapra tragus* Gray, List Spec. Mamm. Brit. Mus., p. 167 (Renaming of *rupicapra*).
1845. *R*[*upicapra*] *capella* Bonaparte, Atti della sesta Riunione degli Scienziati Italiani, Milano, 1844, p. 337 (Renaming of *rupicapra*).
1847. [*Capra rupicapra*] α *sylvatica* Sundevall, Kongl. Vetensk.-Akad. Handl., Stockholm, 1845, p. 284 (Wooded portions of Alps).
1847. [*Capra rupicapra*] β *alpina* Sundevall, Kongl. Vetensk.-Akad. Handl., Stockholm, 1845, p. 284 (Higher portions of Alps).
1857. *Capella rupicapra* Blasius, Säugethiere Deutschlands, p. 488.
1870. *Rupicapra europea* Cornalia, Fauna d'Italia, pt. I, p. 53 (Substitute for *rupicapra*; "Cuv." cited as authority).
1897. [*Rupicapra*] *dorcas* Schulze, Abhandl. u. Vorträge Gesammtb. Naturwissensch., IV, No. 10, p. 9 (Substitute for *rupicapra*).
1910. *Rupicapra rupicapra* Trouessart, Faune Mamm. d'Europe, p. 235.

Type locality.—Switzerland.

Geographical distribution.—Alps and Apennines, eastward through Tirol, the Carpathians and northern portion of Balkan Peninsula to the Caucasus.

Diagnosis.—General colour tawny brown in summer, blackish brown in winter, the sides usually lighter than underparts and

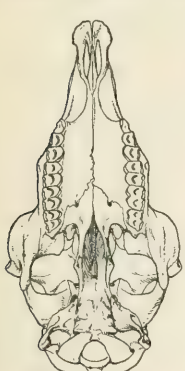


FIG. 212.
Rupicapra rupicapra.
× ½.

FIG. 213.
Rupicapra rupicapra.
Incisiform teeth (nat. size).

legs; a dark dorsal line sometimes present; throat with conspicuous buffy whitish area extending slightly behind interramial region; neck never conspicuously paler on ventral and dorsal surfaces than on sides; a dark line along median dorsal region;

horns essentially perpendicular, the bases of their cores wide enough apart to allow for the presence of a noticeable flattened or double concave area on surface of frontal between them.

Measurements.—Adult male (mounted): head and body, 1100; tail, 40; hind foot, 330; ear from crown, 110; height at shoulder, 690. For cranial measurements see Table, p. 997.

Specimens examined. Twenty-three, from the following localities:—
ITALY: Maratime Alps, 1 (Genoa); Val Formazza, Novara, 1 (Genoa).
SWITZERLAND: No exact locality, 9 (B.M. and U.S.N.M.).
AUSTRIA-HUNGARY: Tirol, 5 (B.M. and U.S.N.M.); Transylvania; S. Carpathians, 2.
No HISTORY: Five.

♂ st.	Tyrol.	H.R.H. Crown Prince Rudolph of Austria (P).	81. 9. 21. 1.
ad. and yg. skeletons.	Tyrol.	Prince Rudolph of Austria (P).	78. 6. 20. 1–2.
2 ♂ skulls.	Alps.	Gen. Hardwicke (P).	631. a. b.
3 frontlets and horns.	Alps.	Dr. J. E. Gray (P).	46. 10. 13. 31–33.
♂ skull.	Alps.	J. Gould (P).	46. 7. 7. 2.
♂ skull.	Alps.	Dr. A. Günther (C).	59. 9. 6. 102.
4 ♂ skulls and frontlets.	——	——	631. d. e. m. n.
♂ st. and skeleton.	Hatszeg, S. Carpathians, Transylvania.	C. G. Danford (C).	86. 12. 27. 1.
Foetus in al.	Hatszeg.	C. G. Danford (P).	94. 6. 26. 2.
Skeleton.	——	Purchased (Brandt).	631. g.

RUPICAPRA ORNATA Neumann.

1899. *Rupicapra ornata* Neumann, Ann. Mus. Civ. Stor. Nat. Genova, XX, p. 347, December 20, 1899. Type in Genoa Museum.
1910. *Rupicapra ornata* Trouessart, Faune Mamm. d'Europe, p. 235.

Type locality.—Barrea, near Alfedena, Province of Aquila, Italy.

Geographical distribution.—Abruzzi Mountains, Italy.

Diagnosis.—General colour as in *Rupicapra rupicapra*, but light throat-patch extending downward nearly to brisket, and dorsal surface of neck almost or quite as pale, the two pale areas separated along side of neck by a dark line extending from base of ear downward and forward to join its fellow of opposite side in region just above brisket: horns slanting much more evidently backward than in *R. rupicapra*, and area of upper surface of brain-case somewhat reduced.

Measurements.—Adult male from the type locality (skin): head and body, 1200; tail, 30; pencil, 120; ear, 110±. For cranial measurements see Table, p. 997.

Specimens examined.—Three, all from the type locality (B.M. and Genoa).

♂.	Abruzzi Mts., Italy.	Genoa Museum (E).	4. 2. 29. 1.

RUPICAPRA PYRENAICA Bonaparte.

1845. *R[upicapra] pyrenaica* Bonaparte, Atti della sesta Riunione degli Scienziati Italiani, Milano, 1844, p. 337.

1878. *Antilope rupicapra* var. Rütimeyer in Trutat, Bull. Soc. Hist. Nat. Toulouse, XII, p. 117.

1910. *Rupicapra rupicapra* Trouessart, Faune Mamm. d'Europe, p. 235 (Part; in synonymy only).

1910. *Rupicapra rupicapra pyrenaica* Cabrera, Proc. Zool. Soc. London, p. 998. December, 1910.

Type locality.—Pyrenees.

Geographical distribution.—Pyrenees.

Diagnosis.—Colour of winter pelage distinctly less dark than in *Rupicapra rupicapra;* markings on neck essentially as in *R. ornata;* horns about perpendicular, placed more closely together than in the other species, the very narrow region of frontal between bases of horn cores single concave; teeth weak.

Measurements.—Adult male from the Pyrenees (no exact locality), from skin: head and body, 1140; tail, 40; hind foot, 344; ear, 95. For cranial measurements see Table, p. 997.

Specimens examined.—Three, all from the Pyrenees, no exact locality (B.M. and U.S.N.M.).

Remarks.—This very distinct species was accurately described, though not recognized by name, by Rütimeyer and Trutat, in 1878.* Since then, until mentioned by Cabrera in 1910 (in description of *R. parva*), it appears to have been completely overlooked.†

1 st.	Pyrenees.	Purchased (Boubée).	48. 2. 5. 7.

RUPICAPRA PARVA Cabrera.

1910. *Rupicapra rupicapra parva* Cabrera, Proc. Zool. Soc. London, p. 999, December, 1910. Type in Madrid Museum.

Type locality.—Picos de Europa, Santander, Spain.

Geographical distribution.—Cantabrian Mountains, Spain.

Diagnosis.—Described as smaller and darker than *Rupicapra pyrenaica,* and with throat-patch very ill-defined, scarcely paler than general colour of body.

Measurements.—Type (adult female): height at shoulder, 570 mm.; length of horn along anterior curve, 146 (Cabrera).

♂ st.	Picos de Europa, Cantabrian Alps.	J. W. R. Lee (C & P).	97. 1. 7. 3.

* Bull. Soc. Hist. Nat. Toulouse, XII, pp. 115–117.

† See Lydekker, Great Game of Europe, Asia and America, p. 185, 1901. Trouessart places the name *pyrenaica* in the synonymy of *rupicapra.*

CRANIAL MEASUREMENTS OF *EUROPEAN BOVIDÆ*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Greatest breadth across orbits.	Mastoid breadth.	Nasal.	Greatest combined breadth of nasals.	Palatal depth at level of m^3.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Third upper molar.	Third lower molar.	Observations.
Ovis musimon.															
Sardinia: Gennargentu	16871	♂	223±	100·6	116·4	—	83·6	33·2	63·6	170·6	63·6	68·0	16·0×10·2	21·8×7·2	m^3 slightly worn.
,,	Genoa	♂	232·0	106·0	125·0	78·0	89·0	31·0	70·0	184·0	70·0	74·0	16·6×11·0	23·0×18·0	,, ,,
,,	,,	♂	212·0	94·6	119·0	78·4	83·0	35·0	72·0	170·0	62·8	65·6	17·0×11·0	21·0×9·0	,, moderately worn.
,,	,,	♂	210·0	100·0	120·0	76·0	78·0	33·0	77·0	177·0	68·0	70·4	18·0×12·0	22·0×8·6	,, slightly worn.
,,	,,	♂	230·0	101·0	117·0	79·0	85·0	36·0	71·4	180·0	71·0	75·0	18·6×10·4	22·6×—	,, ,,
Corsica	174726	♂	219·6	100·8	127·0	78·4	91·8	36·4	77·6	—	63·8	—	17·4×10·2	—	,, moderately worn.
Capra ibex.															
Alps	57. 3. 18. 2	♀	—	105·0	121·0	—	84·0	25·6	57·0		68·6	—	16·0×10·4	—	,, ,,
No history	12287	♀	228·6	108·6	121·0	—	94·6	25·0	63·0	193·4	70·6	73·4	19·4×12·2	24·4×10·0	,, ,,
Italy: Noasca	3318 Turin	♀	—	102·4	122·0	74·0	83·0	26·0	—	—	67·0	—	17·2×11·2	—	,, ,,
,,	6316 ,,	♀	—	98·0	114·0	69·0	80·0	26·0	—	—	70·0	—	17·4×11·0	—	,, ,,
,,	5211 ,,	♂	255·0	112·0	130±	82·6	91·4	30·0	—	203·0	69·0	74·0	19·6×12·0	23·0×11±	,, ,,
,,	5917 ,,	♂	261·0	116·0	131·0	91·0	—	31·0	—	214·0	68·0	73·0	19·8×13·4	25·4×—	,, much worn.
,,	6084 ,,	♂	—	112·0	137·0	85·0	—	30·4	—	205·0	67·4	73·6	21·0×13·0	26·4×—	,, ,,

Capra pyrenaica pyrenaica.																					
Pyrenees . . .	48. 2. 5. 3	♀	—	119·0	139·0	87·0	90·0	30·0	—	194·0	70·0	74·6	20·0	×	13·8	—			m^3 moderately worn.		
Capra pyrenaica victoriæ.																					
Sierra de Gredos . .	1523 Madrid	♂	264·0*	122·0	157·0	—	95·0	40·0	56·5	210·0	68·0	75·0	19·6	×	12·3	26·0	×	9·8	,,	,,	,,
Rupicapra rupicapra.																					
Alps	631 *l*		207·6	90·0	112·0	64·0	60·6	20·0	54·0	170·4	58·0	61·4	13·4	×	10·0	—			Teeth slightly worn.		
Italy: Alpes Maritimes .	Genoa	♀	198·0	86·4	100·0	55·0	62·0	20·0	57·0	168·0	52·0	57·0	13·4	×	9·6	17·0	×	—	,,	much worn.	
Val Formazza .	,,	♂	202·0	87·0	110·0	57·0	65·0	22·4	57·4	168·0	58·0	61·4	14·0	×	10·2	18·0	×	7·6	m^3 moderately worn.		
Tirol	—		189·0	84·0	105·0	59·0	64·0	25·4	53·4	163·0	57·8	61·0	13·4	×	9·0	—			Teeth slightly worn.		
,, ...	81. 9. 21. 1		198·0	89·0	106·0	59·4	69·0	24·0	54·0	—	59·0	—	14·0	×	11·0	—			,,	moderately worn.	
,, ...	882 U.S.N.M.		190·0	81·4	99·6	59·4	—	—	54·0	157·0	56·6	59·6	11·0	×	7·6	15·0	×	5·8	,,	,,	
Transylvania. . .	86. 12. 27. 1		199·0	89·0	108·0	60·0	70·0	27·6	56·0	—	55·4	—	14·0	×	11·8	—			,,	much worn.	
Rupicapra pyrenaica.																					
Pyrenees . . .	174607	♂	190±	85·0	105·0	—	54·6	22·4	50·5	160·0	57·6	59·8	12·4	×	8·4	17·4	×	6·4	m^3 moderately worn.		
,, . . .	174651	♂ juv.	177·6	76·6	98·0	76±	62·6	19·2	49·0	150·4	58·8	62·0	12·6	×	7·0	15·2	×	5·8	,,	not fully in place.	
Rupicapra ornata.																					
Italy: Barrea . .	186A Genoa†	♂	198±	82·0	109·0	—	66·4	26·4	55·0	163·0	56·0	59·4	13·6	×	10·4	18·0	×	8·0	,,	moderately worn.	

* "Total length." All measurements communicated by Cabrera. † Type.

APPENDIX.

Additional material shows the distinctness of the Sardinian *Crocidura* mentioned on pp. 101 and 111–112. The animal has been described as :—

CROCIDURA ICHNUSÆ Festa.

1912. *Crocidura ichnusæ* Festa, Boll. Mus. Zool. Anat. Comp., Torino, XXVII, No. 648, p. 1, March 9, 1912. Type in Turin Museum.

Type locality.—Piscina, Lanusei, Sardinia.

Geographical distribution.—Sardinia.

Characters.—Like *Crocidura sicula*, but unicuspid teeth both above and below fully as large as in *C. russula*, and third upper unicuspid more conspicuously exceeding second than in either of the related species. Brain-case apparently as deep in proportion to its width as in *C. russula*.

Measurements. Type (adult male): head and body, 64 ; tail, 35 ; hind foot, 12. Average and extremes of five adults from Ovile Seardu and Zinnigas: head and body, 65·2 (60–69) ; tail, 36·8 (33·6–39) ; hind foot, 12 (11·8–12·2). Immature female from Assuni: head and body, 61 ; tail, 38 ; hind foot, 11·6. Cranial measurements of type (teeth moderately worn), and of immature female from Assuni (basal suture not closed, teeth not worn): condylobasal length, 18·8 and 18·6 ; zygomatic breadth, 6·2 and 6·0 ; lachrymal breadth, 4·0 and 4·2 ; breadth of brain-case, 9·2 and 8·8 ; depth of brain-case (median), 4·8 and 4·6 ; mandible, 10·4 and 10·0 ; maxillary tooth-row, 8·8 and 9·0 ; mandibular tooth-row, 8·0 and 8·2.

Specimens examined.—Seven, from the following localities in Sardinia: Piscina, Lanusei, 1 (Turin; type); Ovile Seardu, 3 (Genoa); Zinnigas, 2 (Genoa); Assuni, 1 (U.S.N.M.).

The cranial measurements of *Evotomys glareolus norvegicus* were accidentally omitted from Table, pp. 652–653, and are as follows :—

CRANIAL MEASUREMENTS OF *EVOTOMYS GLAREOLUS NORVEGICUS*.

Locality.	Number.	Sex.	Condylobasal length.	Zygomatic breadth.	Interorbital constriction.	Occipital breadth.	Occipital depth.	Nasal.	Diastema.	Mandible.	Maxillary tooth-row.	Mandibular tooth-row.	Observations.
Norway: Mo, Nordland .	173859		25·2	14·6	4·0	—	—	8·0	7·8	15·2	5·4	5·2	Molar roots moderate.
Söndfjord .	84. 10. 31. 12		25·0	13·6	4·2	11·4	6·2	7·2	7·2	15·0	5·6	5·4	,, ,, short.
Bergen . .	84672	♂	25·6	14·4	4·2	11·6	6·6	7·8	7·2	15·4	5·4	5·4	,, ,, moderate.
,, . .	84674*	♀	26·2	14·6	4·0	12·0	6·6	8·0	7·8	16·0	5·8	5·4	,, ,, ,,
,, . .	84675	♂	25·2	14·2	4·0	11·4	6·8	7·8	7·2	15·4	5·4	5·4	,, ,, ,,
Graven . .	84680	♂	24·2	13·8	4·0	11·0	6·0	7·0	7·2	14·6	5·4	5·6	,, ,, ,,
,, . .	84683	♂	24·4	13·4	4·0	11·2	6·2	7·2	7·2	15·2	5·4	5·2	,, ,, ,,
,, . .	84685	♂	24·8	13·6	4·0	11·2	6·0	7·0	7·0	14·8	5·4	5·4	,, ,, long.
,, . .	84676	♀	24·2	13·0	4·0	11·2	6·2	7·6	7·2	15·0	5·4	5·4	,, ,, ,,
,, . .	84679	♀	24·8	13·8	4·0	11·6	7·0	7·4	7·2	15·2	5·6	5·4	,, ,, ,,
,, . .	84681	♀	25·0	13·8	4·0	11·0	6·2	7·6	7·2	15·4	5·4	5·4	,, ,, moderate.
,, . .	84689	♀	24·4	13·6	4·0	11·2	6·2	7·0	7·0	15·0	5·2	5·2	,, ,, ,,

* Type.

Genus *Spalax* (pp. 887–896). The living forms recognized by Méhely (Species Generis Spalax. A Földi Kutyák Fajai Származás- és Rendszertani Tekintetben, Budapest, 1909) as occurring in Europe west of Russia, are as follows:*—

Sub-genus *Mesospalax* (p. 22). New sub-genus to contain the species *monticola* and *hungaricus*. No type designated.

Spalax monticola monticola Nehring. Type locality: Kupres, Bosnia.† (Type in Agricultural High School, Berlin.)

Spalax monticola turcicus Méhely (p. 25). Type locality: vicinity of Makri-Köi, Constantinople, Turkey. (Type in Bulgarian Royal Museum.)

Spalax monticola dolbrogeæ Miller.

Spalax monticola hellenicus Méhely (p. 29). Type locality: Lamia, Thessaly, Greece. (Type in Hungarian National Museum.)

Spalax monticola hercegovinensis Méhely (p. 30). Type locality: Ulog-Obruja, Herzegovina.† (Type in Agricultural High School, Berlin.)

Spalax monticola syrmiensis Méhely (p. 30). Type locality: Ó-Pazuá, Szerem, Slavonia, Austria-Hungary. (Type in Agram Museum.)

Spalax monticola serbicus Méhely (p. 31). Type locality: Servia. (Type in Hungarian National Museum.)

Spalax hungaricus hungaricus Nehring.

Spalax hungaricus transsylvanicus Méhely (p. 31). Type locality: Transylvania. (Type in Hungarian National Museum.)

Sub-genus *Macrospalax* (p. 23). New name for sub-genus *Spalax*.

Spalax græcus græcus Nehring. Type and paratype said to have been taken in Greece; two other specimens from the vicinity of Czernowitz, Bukowina, Austria-Hungary.

Spalax istricus Méhely (p. 34). Type locality: Barza, Roumania. (Type in Hungarian National Museum.)

Spalax polonicus Méhely (p. 35). Type locality: vicinity of Lemberg, Galicia, Austria-Hungary. (Type in Lemberg Museum.) As synonyms are cited: *Podolian Marmot* Pennant, Synopsis, p. 271, 1771, and *Glis zemni* Erxleben, Syst. Regni Anim. 1, p. 370, 1777.

* Types of the new forms are apparently not designated; but the lists of material examined furnish indications of the specimens on which the descriptions are mainly based.

† In the original description of *monticola* Nehring mentions two specimens: (*a*) from Bosnia, and (*b*) from Herzegovina. Neither is designated as type. As *a* is young and *b* adult, and Nehring expressly notes that the characters of the species are particularly well shown by *b*, I assumed (p. 894) that *b* should be regarded as the type. Méhely states (p. 121) that *a* is the type of *monticola*. He bases his description of *hercegovinensis* on Nehring's specimen *b* exclusively.

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LONDON:
PRINTED BY WILLIAM CLOWES AND SONS, LIMITED.
DUKE STREET, STAMFORD STREET, S.E., AND GREAT WINDMILL STREET, W.

1944-45
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